Recreational Use Attainability Analysis for White Oak Creek (0303B) in the Sulphur River Basin

Prepared for:
Texas State Soil and Water Conservation Board
Project 16-60

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Chapter 1
Introduction

Problem Statement

White Oak Creek (0303B) is an unclassified water body identified for assessment purposes by the Texas Commission on Environmental Quality (TCEQ). White Oak Creek is approximately 120 river miles long and is defined in the 2014 Texas Integrated Report of Surface Water Quality (TCEQ, 2014a) as being located from the confluence with the Sulphur River north of Naples in Morris County to the upstream perennial portion of the stream east of Sulphur Springs in Hopkins County (Figure 1.1). Four assessment units (AUs) have been established by TCEQ for White Oak Creek (0303B). Starting at the confluenc with the Sulphur River, White Oak Creek has been designated as AU 0303B_01 upstream to the confluence with Lacy Creek. The section of White Oak Creek located from the confluence with Lacy Creek upstream to the confluence with Ripley Creek has been designated as AU 0501B_02. The third AU (0303B_03) is described as the portion from the confluence with Ripley Creek upstream to the confluence of Stouts Creek. The fourth and final AU is the upper-most portion of White Oak Creek from the confluence with Stouts Creek upstream to Midget Creek. AUs 0303B_01 and 0303B_04 were first listed on the Texas 303(d) list as impaired for bacteria in 2006 and have continued to be listed as impaired for bacteria in the 2008, 2010, 2012, and 2014 Texas 303(d) lists. Depressed dissolved oxygen is identified within all four AUs and first listed as an impairment on the 2000 Texas 303(d) list. The TCEQ website for The Texas Integrated Report of Surface Water Quality[1] includes the Texas 303(d) list of impaired water bodies list dating back to 1992.

White Oak Creek (0303B) has a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2014b). Prior to June 2010 only two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the TCEQ adopted revisions to the TSWQS that expanded the designation of contact recreation into three categories (primary contact recreation, secondary contact recreation 1, and secondary contact recreation 2) based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30 Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010). As a result of these revisions to the TSWQS, all water bodies listed as impaired based on bacteria for contact recreation are scheduled to undergo a standards review to determine if primary contact recreation is appropriate or if a revision to the use category for recreation should be considered.

Use attainability analyses (UAAs) are studies to evaluate the designated or presumed uses of a water body. In order to identify and assign attainable uses and criteria to individual water bodies, UAAs evaluate physical, chemical, biological, and economic factors affecting use attainment of a water body (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a water body, the findings of which are presented within this report for White Oak Creek (0303B).

[1] https://www.tceq.texas.gov/waterquality/assessment/305_303.html

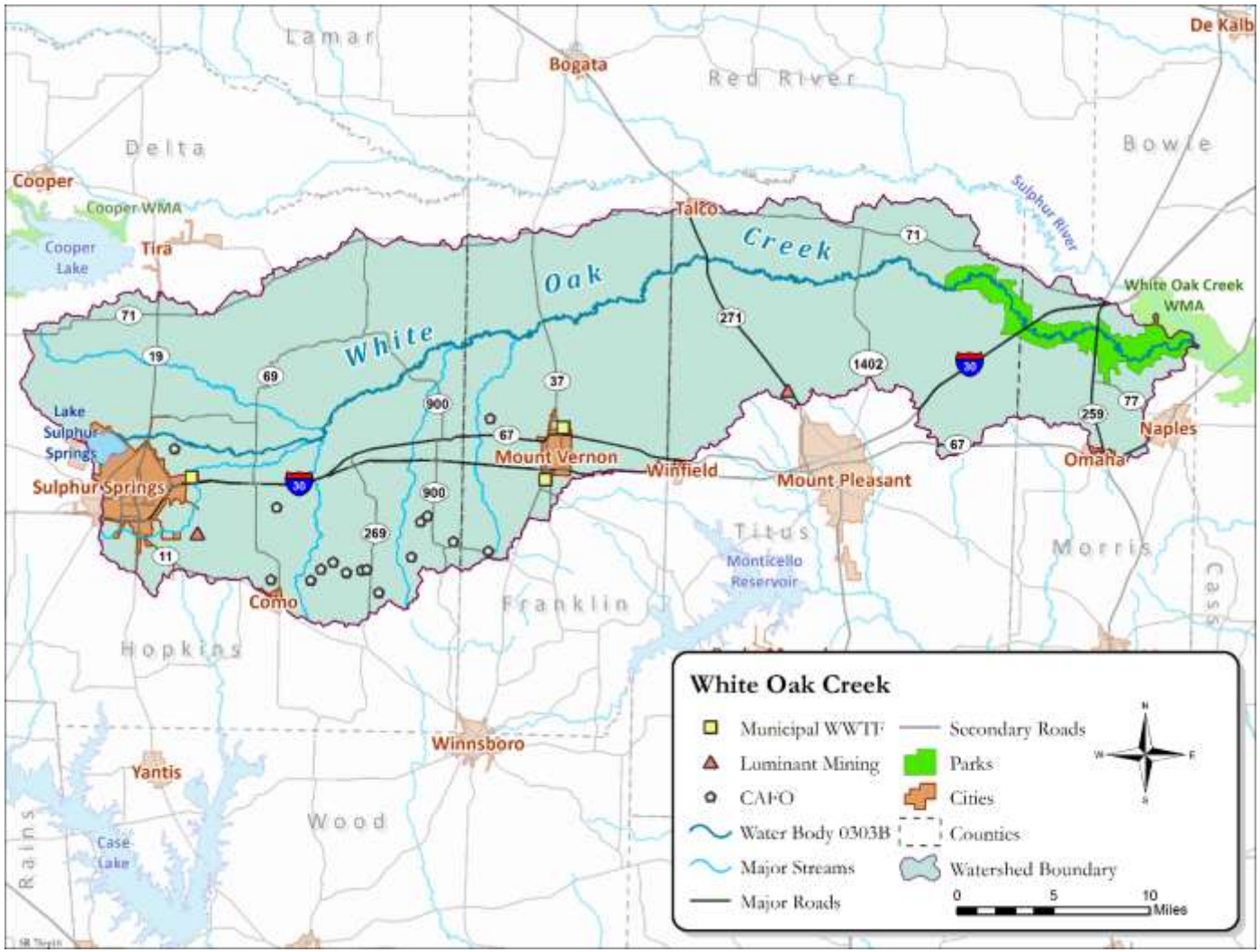

Figure 1.1 Watershed of White Oak Creek (0303B).

Objectives

The objective of this report is to present the findings of a Comprehensive RUAA for White Oak Creek following the TCEQ March 2014 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2014c). A RUAA consists of three parts: field surveys to document water body characteristics and signs of recreation, interviews with stakeholders regarding past and current use of the water body, and a historical review regarding recreational use of the water body. All components of this RUAA were performed by Texas Institute for Applied Environmental Research (TIAER), which is located on the campus of Tarleton State University in Stephenville, Texas. Field surveys and interviews for the RUAA were conducted under a Texas State Soil and Water Conservation Board (TSSWCB) approved Quality Assurance Project Plan (QAPP; TIAER, 2016).

Stakeholder and Agency Involvement

The TSSWCB and its collaborating entities maintain an inclusive public participation process. From the inception of this project, the team sought to ensure that stakeholders were informed and involved. TIAER provided coordination for public participation for this project.

Input from the TCEQ regional staff, Texas Parks and Wildlife Department (TPWD) regional staff, TSSWCB, the Sulphur – Cypress and Hopkins – Rains Soil and Water Conservation Districts, Sulphur River Basin Authority (SRBA), and other local agencies was solicited as well as input from watershed stakeholders on the need for the RUAA (see Contact Information Form available on the project website noted below).

Meetings with state agencies, river authority representatives, local officials, and stakeholders were held to give an overview of water quality issues within the White Oak Creek watershed and to obtain comments on proposed survey sites prior to field data collection. These meetings targeted local and state agencies as well as stakeholders to inform them of the assessment of water quality within White Oak Creek and the need for a RUAA. TIAER representatives met with the Sulphur – Cypress Soil and Water Conservation District on February 11, 2016 and Hopkins – Rains Soil and Water Conservation District on February 16, 2016.

Due to the large size of the White Oak Creek watershed, two identical public meetings focusing specifically on introducing the RUAA in White Oak Creek were held in April 2016. The first was held at the Hopkins County Civic Center in Sulphur Springs on April 4, 2016, and the second was held at the Mount Pleasant Civic Center in Mount Pleasant on April 5, 2016. At this meeting input was sought on the proposed survey sites for the White Oak Creek RUAA. Attendees provided information regarding activities that typically occur within the watershed and offered assistance in accessing the stream via privately owned property.

The second set of public meetings were held on August 8th and 9th at the Hopkins County Civic Center and Titus County Extension Office, respectively. The purpose of these identical meetings was to provide stakeholders with the findings from the first RUAA field survey (conducted June 22 – 23, 2016 and July 19 – 22, 2016) and promote interview forms regarding stakeholder's input of the water body's recreational usage. Again, to accommodate logistical convenience for stakeholders, two identical meetings were held in the watershed. The importance of interviews to provide feedback on past recreational use was emphasized by TIAER. Interview forms were made available at this meeting as well as through the project website. Several attendees agreed to complete interviews.

Final public meetings will occurr November 13 and 14, 2017 at the Mount Pleasant Civic Center and the Hopkins County Civic Center, respectively, to inform stakeholders of the findings of both field surveys. The next steps of the RUAA will be discussed at this meeting and feedback from stakeholders will be solicited. At the meeting, stakeholders will be informed that the draft RUAA report is open for public review and comment. The draft report is available via the project website. Additionally, hard copies are provided by TIAER upon request.

Watershed stakeholders were invited to attend public meetings through mailed invitations, public announcements (TCEQ and TSSWCB webpages), and individual phone calls. Information on past meetings for this RUAA, presentations, and other information, can be found on the project's website: White Oak Creek Project Webpage[2]

[2] http://tiaer.tarleton.edu/ruaa/white-oak-creek.html

Chapter 2
Study Methodology

The process of developing a list of sites to be surveyed for the RUAA began with a reconnaissance of potential locations along each water body. A combination of Geographic Information System (GIS) data, review of historical information, and meetings and phone conversations with local entities and stakeholders were used to determine sites included in the RUAA field surveys.

Watershed Reconnaissance and Site Selection Strategy

Reconnaissance of each watershed was conducted to collect background information before selecting appropriate sites for each RUAA. To the degree possible, site reconnaissance was coordinated with watershed stakeholders in an effort to increase local landowner interest in water quality issues. The March 2014 RUAA procedures (TCEQ, 2014c) recommend selecting three sites per every five miles of stream. Based on this recommendation, the recommended number of sites for White Oak Creek was 71.

The following information was compiled using Geographic Information System (GIS) based tools prior to, during, and immediately following the watershed reconnaissance:

- Location of areas along the water body that were accessible to the public and had the highest potential for recreational use, such as road crossings and parks;
- Location of permitted wastewater outfalls and other potential point sources;
- Hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations; and
- Location of city boundaries or other designated population areas.

The site selection process took into account locations that were accessible to the public, had the highest potential for recreational use, and that were established TCEQ monitoring stations where historical data may have been collected. The site selection process also considered parks and bridge crossings along the river, as well as access through private lands adjacent to the river.

Survey Methods

Field Survey Data Collection Activities

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2014c), two separate field surveys occurred at each selected survey site during the warm season (air temperature greater than or equal to 70 degrees Fahrenheit or 21 degrees Celsius) when human recreational activities were most likely to occur (May - September). Ideally, field surveys were to be conducted when stream flow conditions were normal. Rainfall data 30 days prior to each survey were also documented to provide antecedent conditions.

Data collection activities at each RUAA site for both field surveys included the following:

- Measurement of average depth at thalweg (deepest depth),
- Measurement of depths, lengths, and widths of substantial pools,
- Documentation of observational/anecdotal data required on the RUAA field data sheets,
- Photographs of any signs of recreation, and
- Photographs of site conditions including upstream, downstream, left bank, and right bank photos at the 0-m, 150-m, and 300-m transects.

Average Depth at Thalweg and Substantial Pool Depths

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2014c). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was defined as a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of the RUAA survey (TCEQ, 2014c).

As instructed in the RUAA procedures manual (TCEQ, 2014c), a 300-m reach at each site was evaluated to determine average thalweg depth. Eleven transects at 30-m intervals were established along the reach. Transects were labeled upstream to downstream with the 300-m transect at the most upstream point of the survey and the 0-m transect being the most downstream. Thalweg was measured at each of the eleven transects. Where significant pools were encountered along the 300-m reach, depths, widths, and lengths were measured and recorded. Depths, lengths, and widths are presented in meters as per the RUAA procedures (TCEQ, 2014c).

Observational /Anecdotal Data

Anecdotal information was recorded on field data sheets during all surveys using the field data sheets from the TSSWCB-approved QAPP (TIAER, 2014c).

Types of observational and anecdotal records included, but were not limited to, the following:

- Channel flow status as indicated by flow severity
- Stream type (e.g., ephemeral, intermittent, etc.)
- Riparian zone characteristics (forest, pasture, eroded banks, etc.)
- Stream accessibility
- Substrate type
- Anecdotal information related to observed human contact activities

Photographs

TIAER staff created photographic records of each site during the surveys. Photographs were intended to clearly depict the characteristics of the channel and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were taken specifically at the 0-m, 150-m, and 300-m transects (as described in the Field Data Sheets). Any items of interest, e.g., obstructions, were also photographed. Photographs were used to document evidence of

recreational use (e.g., fishing tackle) and actual recreation. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition, as part of the overall project, photographs were taken to indicate potential bacteria sources to the water body. All photographs were labeled in a manner that indicated the date, site location, orientation to the stream, and photo's subject. Selected photos representative of each RUAA field site are included with the survey results for each water body in this report.

Chapter 3
Study Area

Description of White Oak Creek

White Oak Creek is located in Hopkins, Franklin, Titus, and Morris Counties within the Sulphur River Basin in the north eastern portion of Texas. The White Oak Creek watershed is approximately 471,600 acres (737 square miles) and includes the cities of Sulphur Springs and Mount Vernon, Texas. The watershed overlaps small portions of the cities of Como, Talco, Millers Cover, and Omaha. The most downstream section of White Oak Creek (AU 0303B_01) flows through the White Oak Creek Wildlife Management Area (WMA) (Figure 1.1).

White Oak Creek Wildlife Management Area

White Oak Creek WMA is managed by the Texas Parks and Wildlife Department under a license agreement with the US Army Corps of Engineers. It serves as a site to perform research on wildlife populations and habitat as well as provide public education on proper conservation practices. The WMA also provides public access for fishing, hiking, horseback riding, and wildlife viewing year round, except when closed for special permit hunts that run roughly from September 24 – April 16. Public hunting is available to properly permitted individuals for white-tailed deer, feral hog, spring eastern turkey, quail, mourning dove, waterfowl, early teal, duck, woodcock, rail, gallinule, snipe, squirrel, rabbits, hares, and furbearers.

The White Oak Creek WMA is approximately 25,777 acres of primarily bottomland hardwood forest, with 12,849 acres (about 50%) located within the White Oak Creek watershed. Approximately 28 miles (23%) of White Oak Creek flows through the WMA. White Oak Creek WMA is the only park within the White Oak Creek watershed and can be accessed by street vehicle, ATV, horse, foot, and boat, although paved roads are limited to the perimeter of the WMA. Internal roads and trails are rudimentary/non-maintained and primarily accessible only by foot, ATV. or horse. Internal WMA roads and trails are unavoidably submerged during times of high water, restricting access then to only watercraft.

Within the portion of the WMA that exists in the White Oak Creek watershed, there are ten designated entrance and information stations with parking, two small craft/boat launches, and two specified equestrian trail heads. The WMA's webpage[3] informs the public of the absence of restroom facilities, to bring one's own drinking water, that insect repellant is advised, and to be aware of potential dangers, such as poison ivy and venomous snakes. The public is also made aware that flooding occurs during heavy rains and, during such an event, to move to higher ground.

A map depicting the WMA boundary, public hunting areas, designated entrances, boat and canoe ramps, equestrian trails and parking areas is below (Figure 3.1).

[3] https://tpwd.texas.gov/huntwild/hunt/wma/find_a_wma/list/?id=35

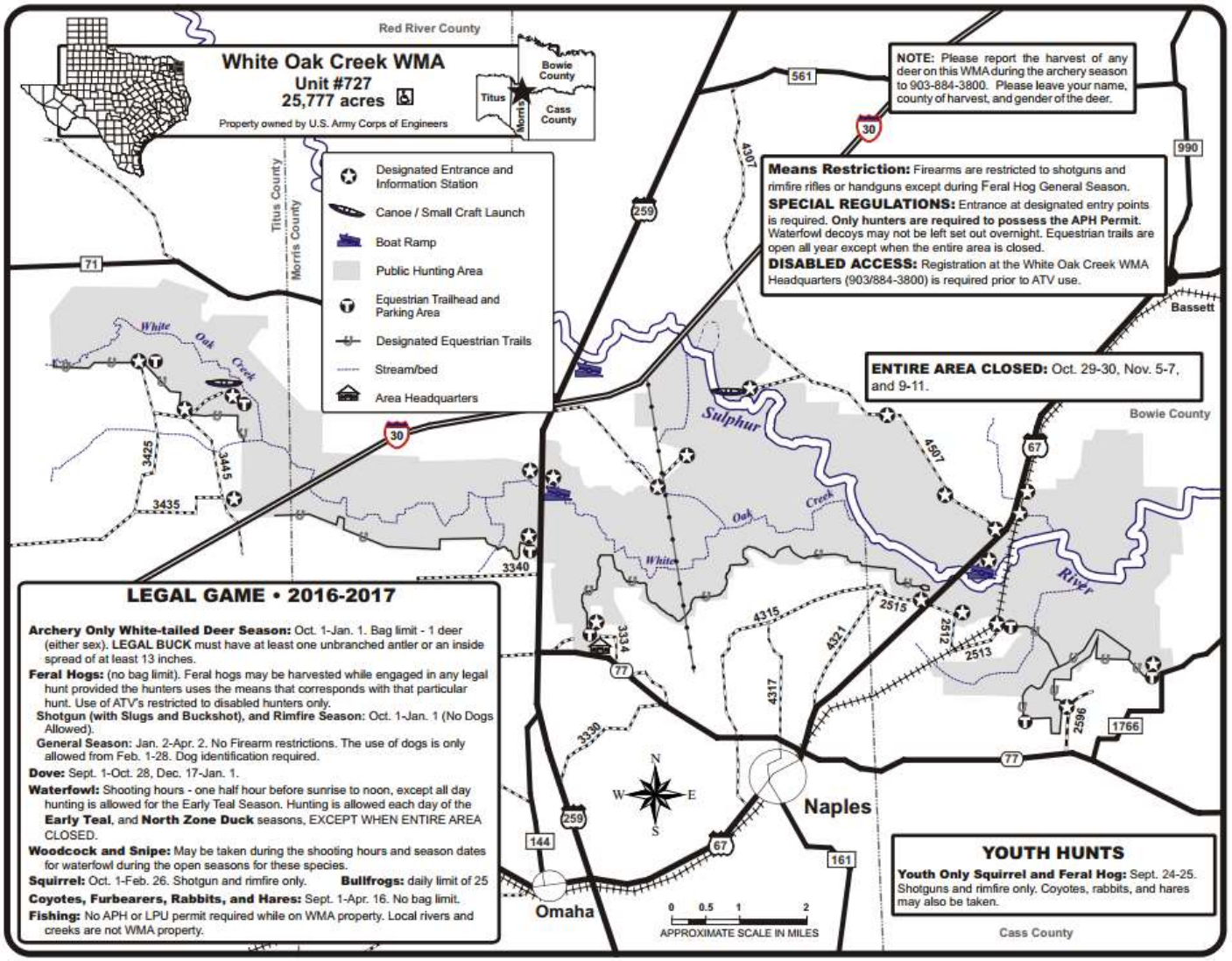

Figure 3.1 White Oak Creek Wildlife Management Area.

Source: Texas Locator Map of Public Hunting Areas (TPWD, 2016).

Climatic Conditions

Annual average total precipitation for the White Oak Creek watershed was based on data obtained from the National Oceanic and Atmospheric Administration's website (NOAA, 2015) for Pittsburg, Mount Vernon, Mount Pleasant, and Omaha, Texas. Normal precipitation (1975-2015) for the White Oak Creek watershed averages 45.7 inches per year with peak rainfall typically occurring in the months of March and May (Figure 3.2).

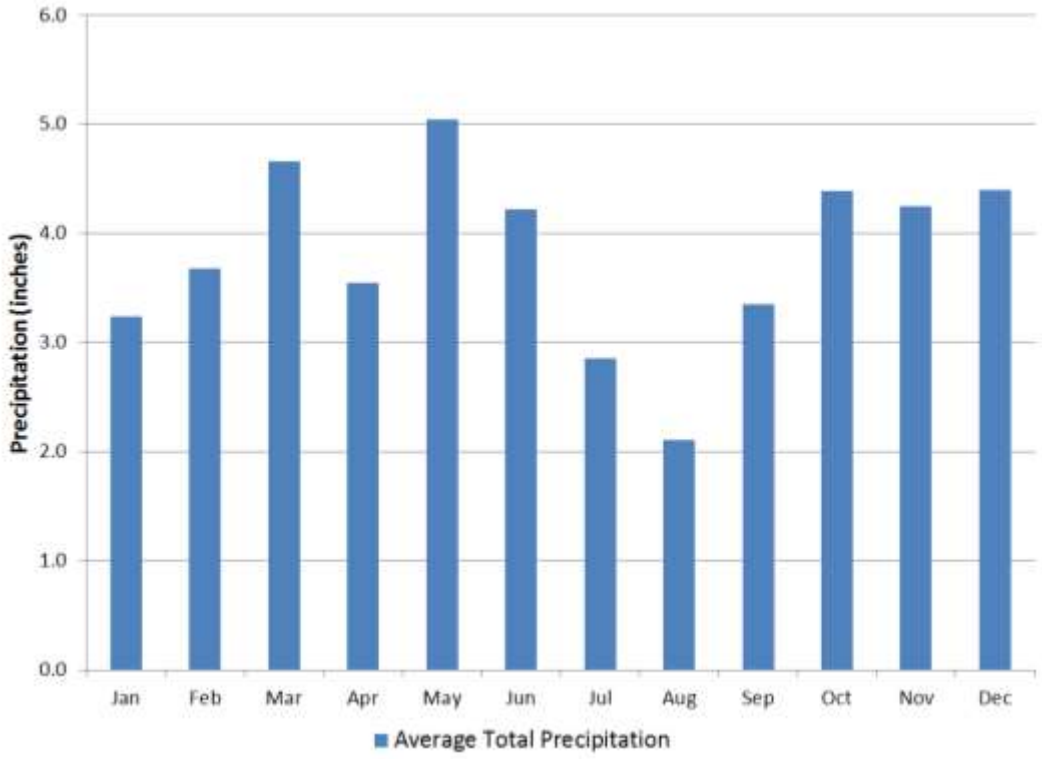

Figure 3.2 Monthly average precipitation for White Oak Creek watershed.

Source: NOAA (2015) based on data for 1974-2015.

Average maximum temperatures for the White Oak Creek watershed rise above 70ºF beginning in March and continue through October (Figure 2.3). March through October are the months noted as generally suitable for assessing recreational use, but only if temperatures reach above 70ºF (TCEQ, 2014c).

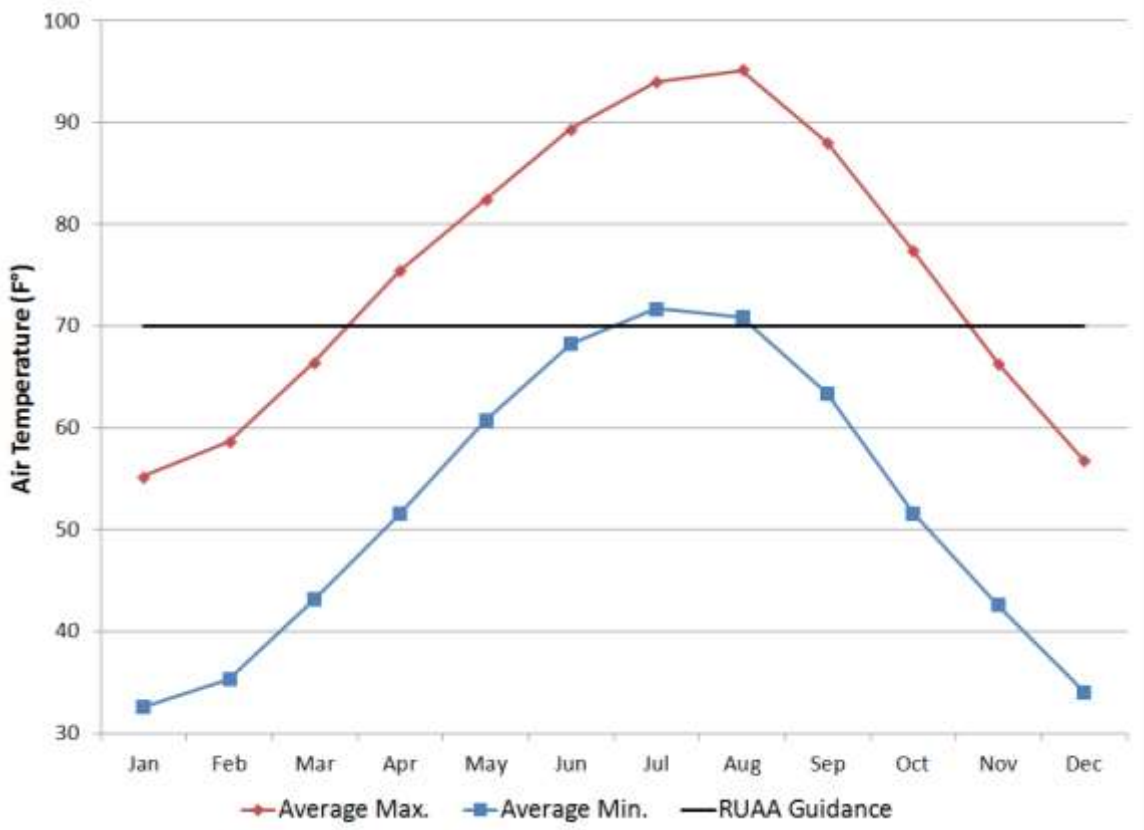

Figure 3.3 Monthly average maximum and minimum air temperatures for the White Oak Creek watershed compared to RUAA guidance for field surveys.

Source: NOAA (2015) based on data for 1974-2015 and TCEQ (2014).

Land Use and Land Cover

The White Oak Creek watershed lies within three ecoregions in Texas (Griffith et al., 2007). Covering the majority of the watershed at 95.7%, the East Central Texas Plains ecoregion alternates between bands of post oak woods or savanna on areas of sandy soil and blackland prairies on more clayey soils. The White Oak Creek watershed includes 4% of the Texas Blackland Prairies ecoregion. The Texas Blackland Prairies is differentiated from surrounding regions by fine-textured, clayey soils and predominantly prairie potential vegetation. Thus, this region contains a higher percentage of cropland than adjacent regions. The South Central Plains ecoregion, locally coined as the "piney woods," spreads across a mere 0.3% of the White Oak Creek watershed. Soils in this ecoregion are mostly acidic sands and sandy loams.

The marginal majority land cover within the White Oak Creek is pasture/hay at 50.5% and spread throughout the watershed (Table 3.1 and Figure 3.4). Woody wetlands and deciduous forest are especially prevalent in the eastern portion of the watershed and cover much of the White Oak WMA. The combined developed land use classes represent approximately 6.5% of the watershed area and are mostly located within or in close proximity to the City of Sulphur Springs.

Table 3.1 Land use/land cover classes within the White Oak Creek watershed.

Source: 2006 National Land Cover Database (USGS, 2006).

Class	Area (acres)	Percent (%)
Pasture/Hay	238,028	50.5
Deciduous Forest	76,074	16.1
Woody Wetlands	62,759	13.3
Cultivated Crops	28,129	6.0
Shrub/Scrub	20,637	4.4
Developed, Low Intensity	20,291	4.3
Developed, Open Space	6,965	1.5
Open Water	5,202	1.1
Evergreen Forest	3,196	0.7
Grassland/Herbaceous	2,971	0.6
Emergent Herbaceous Wetlands	2,955	0.6
Developed, Medium Intensity	2,248	0.5
Developed, High Intensity	925	0.2
Barren Land (Rock/Sand/Clay)	744	0.2
Mixed Forest	469	0.1
Total	471,593	100.0

- **Pasture/Hay** – Area of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- **Deciduous Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
- **Woody Wetlands** – Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Cultivated Crops** – Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
- **Shrub/Scrub** – Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- **Developed, Low Intensity** – Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.

- **Developed, Open Space** – Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Open Water** – Areas of open water, generally with less than 25% cover of vegetation or soil.
- **Evergreen Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
- **Grassland/Herbaceous** – Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Developed, Medium Intensity** – Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
- **Developed High Intensity** – Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
- **Barren Land (Rock/Sand/Clay)** – Areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earthern material. Generally, vegetation accounts for less than 15% of total cover.
- **Mixed Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.

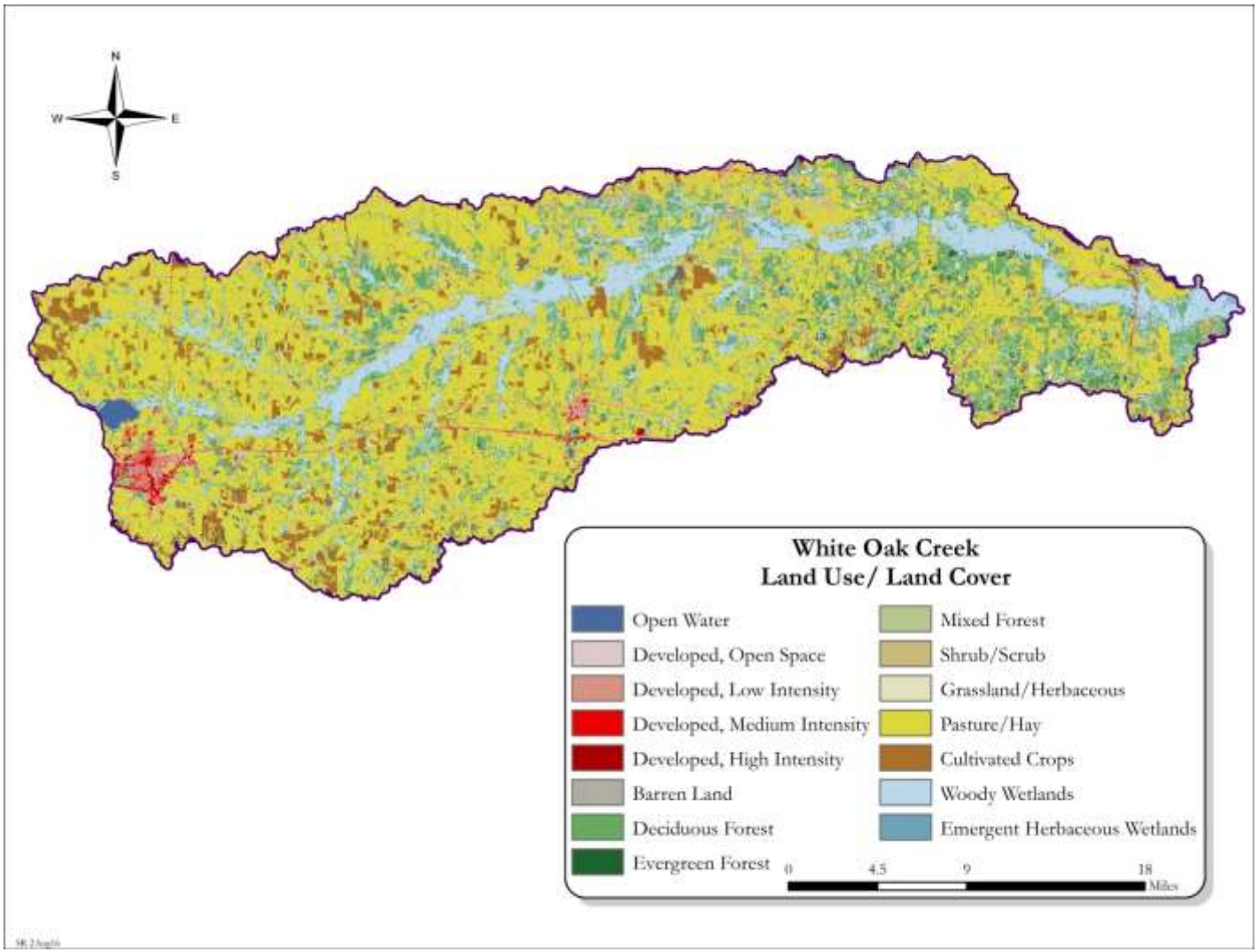

Figure 3.4 Land use and land cover of the White Oak Creek watershed.

Source: 2006 National Land Cover Database (USGS, 2006).

Regulated Sources

Potential sources of fecal pollution, as measured by indicator bacteria *Escherichia coli (E. coli)*, can be divided into two primary categories: regulated and unregulated. Pollution sources which are regulated are issued permits by TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) and/or by the USEPA under the National Pollutant Discharge Elimination System (NPDES) and are generally point sources. Examples of regulated sources include domestic and industrial wastewater treatment facilities (WWTFs); stormwater from industries, construction, and municipal separate storm sewer systems (MS4s) of cities; and concentrated animal feeding operations (CAFOs). These various regulated sources are required to have either an individual permit that is specific for each facility or a general permit for operation.

Wastewater Discharge Facilities

There are three municipal wastewater treatment facilities (WWTFs) within White Oak Creek (0303B) watershed, one associated with the City of Sulphur Springs and two with the City of Mount Vernon. None of these three WWTFs discharge directly into White Oak Creek, but into upstream creeks or tributaries of White Oak Creek. The largest permitted discharge is the City of Sulphur Springs with a permitted average daily flow of 5.4 MGD. There are also two wastewater discharge permits associated with the Luminant Mining Company for discharges from retention or treatment ponds (Table 3.2). One Luminant Mining Company (LMC) facility (WQ0004122000) is located on State Highway 11 approximately 2.5 miles from the intersection of Interstate 30 in Hopkins County with nine retention ponds that discharge to tributaries eventually reaching White Oak Creek. The other LMC facility (WQ0002697000) is located between the City of Winfield in Titus County and the City of Mount Pleasant in Franklin County with only two of six retention ponds with outfalls associated with tributaries of White Oak Creek.

Regulated Stormwater

The TPDES and the NPDES Municipal Separate Storm Sewer (MS4) Phase I and II rules require municipalities and certain other entities in urban areas to obtain permits for their stormwater systems. Phase I permits are individual permits for large and medium sized communities with populations exceeding 100,000, whereas Phase II permits are for smaller communities located within an "Urbanized Area." An "Urbanized Area" is defined by the U.S. Census Bureau (USCB, 2010) as an area with populations greater than 50,000 and with an overall population density of at least 1,000 people per square mile. Because there are no urbanized areas within the White Oak Creek watershed, there are no entities required to obtain a stormwater permit.

Concentrated Animal Feeding Operations

There are 12 active general permits and five either expired or canceled general permits for concentrated animal feeding operations (CAFO) within the White Oak Creek watershed (Table 3.3). Of the 12 active general permits, 10 are located in Hopkins County. Two active CAFO permits are in Franklin County. There are no active, expired, or canceled CAFO permits in Titus or Morris Counties.

Table 3.2 Permitted Discharge Facilities within the White Oak Creek (0303B) watershed

Facility Name	Permitted Average Daily Flow (MGD)	Receiving Water Body	NPDES ID	TPDES Permit No.	Latitude	Longitude
Luminant Mining Company LLC	Retention ponds, discharge reported	Nine retention ponds with outfalls to an unnamed tributary, hence to Rock Creek, White Oak Creek to Sulphur/South Sulphur River Segment 0303	TX0071081	WQ0004122000	33.108028	-95.543861
Sulphur Springs WWTF	5.4	Rock Creek, hence to White Oak Creek to Sulphur/South Sulphur River Segment 0303	TX0058955	WQ0010372001	33.150417	-95.550417
City of Mount Vernon WWTP	0.02	Denton Creek, hence to Big Creek, White Oak Bayou to Sulphur/South Sulphur River Segment 0303	TX0075540	WQ0011122001	33.154694	-95.233556
City of Mount Vernon WWTP	0.425	Town Branch, hence to Bear Pen Creek, White Oak Creek to Sulphur/South Sulphur River Segment 0303	TX0063096	WQ0011122002	33.194556	-95.2175
Luminant Mining Company LLC	Retention ponds, discharge reported	Six retention ponds outfalls two of which discharge to East Piney Creek, Piney Creek, Ripley Creek, Doresey, and their tributaries to White Oak Creek, thence to Sulphur/South Sulphur River Segment 0303*	TX0068357	WQ0002697000	33.225361	-95.017972

*Receiving water bodies for Luminant Mining Company LLC: The other four retention ponds have outfalls discharging to Tankersley Creek (above Tankersley Lake), hence to Tankersley Lake, Dragoo Creek, Tankersley Creek (below Tankersley Lake), Hayes Creek

(above New City Lake), New City Lake, Hayes Creek (below New City Lake), Hart Creek to Big Cypress Creek Below Lake Bob Sandlin Segment 0404, and Smith Creek, hence to Blundell Creek to Lake Bob Sandlin Segment 0408.

Table 3.3 Concentrated Feeding Operations (CAFOs) within the White Oak Creek (0303B) watershed

Facility Name	County	ID Number	Status	Latitude	Longitude
Abo Dairy	Hopkins	TXG921279	Active	33.129444	-95.473611
Belle Vue Dairy	Hopkins	TXG921233	Active	33.030166	-95.502333
Sonador Dairy	Hopkins	TXG921364	Active	33.074840	-95.477315
Jacobs Dairy	Hopkins	TXG920116	Active	33.083611	-95.432777
Martin Springs Dairy	Hopkins	TXG920029	Expired	33.171700	-95.566583
Oud Dairy 3	Hopkins	TXG921356	Active	33.089166	-95.422166
Oud Dairy 1	Hopkins	TXG921361	Active	33.083500	-95.396333
Oud Dairy 2	Hopkins	TXG921357	Active	33.084166	-95.391666
Petal Dairy	Hopkins	TXG920170	Cancelled	33.121000	-95.344666
Milky Way Farms Dairy	Hopkins	TXG921006	Cancelled	33.066944	-95.380555
Still Meadow Dairy	Hopkins	TXG920117	Active	33.081333	-95.410000
Van Rijn Dairy 1	Hopkins	TXG920133	Active	33.125500	-95.338383
Krause Dairy	Hopkins	TXG921310	Active	33.075000	-95.441666
Huisman Dairy	Hopkins	TXG920749	Expired	33.094444	-95.352222
Coenen Dairy	Franklin	TXG921163	Active	33.200000	-95.284166
Pleasant Hill Dairy	Franklin	TXG920136	Active	33.100000	-95.283333
Ten Cent Dairy	Franklin	TXG920202	Cancelled	33.106666	-95.314833

Potential Unregulated Sources

Unregulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple diffuse locations and is usually carried to surface waters by rainfall runoff, and the sources are not regulated by permit under the TPDES and NPDES. Potential unregulated sources include wildlife (mammals and birds), large exotics, unmanaged feral animals (e.g., feral hogs), on-site sewage facilities (OSSFs), pets, and livestock.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to water bodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby water bodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2012). While these are county level statistics and thus only a very rough estimate of livestock in the watershed (Table 3.4), these statistics indicate that beef cattle, goats, and horses are the most common livestock found within the watershed.

Table 3.4 Estimated livestock numbers within the White Oak Creek watershed based on statistics for Hopkins, Franklin, Titus, and Morris Counties and adjusted for the percent of the county represented by the watershed. (Source: USDA, 2012).

The White Oak Creek watershed comprises about 46% of Hopkins County, 21% of Franklin County, 26% of Titus Count, and 7% of Morris County.

County	Cattle & Calves (all beef)	All Goats	All Sheep	Horses & ponies	Hogs & Pigs
Hopkins	110,278	1,354	875	2,956	118
Franklin	28,217	408	(D)*	124	17
Titus	24,219	782	247	225	397
Morris	19,898	812	100	707	82
Proportional Average for White Oak Creek Watershed	64,343	969	474	1,494	167

*USDA Census Data withheld to avoid disclosing data for individual farms.

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (USEPA, 2009). A rough estimate of the dog and cat population can be computed assuming there are 0.584 dogs and 0.638 cats per household (AVMA, 2012). According to the 2010 census there are 14,475 households within the White Oak Creek watershed which indicates that there are potentially 8,453 dogs and 9,235 cats residing within the watershed.

Wildlife

E. coli bacteria are common inhabitants of the intestines of all warm blooded animals, including wildlife such as mammals and birds. Wildlife is naturally attracted to riparian corridors of streams and rivers. With direct access to the stream channel, the deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where it may be washed into nearby streams by rainfall runoff.

Failing On-Site Sewage Facilities

On-site sewage facilities (OSSFs) are often used in rural areas without access to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CCNs) from the Public Utility Commission of Texas was used. Because not all cities with WWTFs have CCNs, the CCN layer was supplemented with a GIS layer representing municipal boundaries. Population data from the U.S. Census Bureau were then overlaid masking out areas that would likely be serviced by WWTFs. Of the 14,475 households in the White Oak Creek watershed, approximately 38.7% were outside of areas serviced by WWTFs and thus likely on OSSFs.

Historical Information on Recreational Use

A review of historical information was performed regarding recreational water uses for White Oak Creek. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review and searches.

Government Sources:

City of Sulphur Springs
City of Sulphur Springs Homepage[4]
Nothing significant was found.

City of Mount Vernon
City of Mount Vernon Homepage[5]
Nothing significant was found.

City of Mount Pleasant
City of Mount Pleasant Homepage[6]
Nothing significant was found.

Texas Parks and Wildlife
Luke Baker
White Oak WMA
Phone: (903) 884-3800
Contacted on March 7, 2016 by Leah Taylor and Sarah Robinson
Mr. Baker stated he was unaware of any primary contact recreational uses such as swimming or children wading in White Oak Creek.

Sulphur River Authority
Mike Buttram and Nancy Rose
Special Projects Administrator
(903) 223-7887
Contacted on March 14, 2016 by Leah Taylor
Mr. Buttram stated he was unaware of any primary contact recreational uses such as swimming or children wading in White Oak Creek.

Library Sources:

The City of Sulphur Springs Public Library
City of Sulphur Springs Public Library Homepage[7]
Phone: (903) 885-4926
Searched online catalog. Nothing significant was found.

Franklin County Public Library
Franklin County Public Library Homepage[8]
Phone (903) 537-4916
Searched online catalog. Nothing significant was found.

City of Mount Pleasant Library
City of Mount Pleasant Library Homepage[9]
Phone (903) 575-4180
Searched online catalog. Nothing significant was found.

Newspaper Sources:

My SS News
My SS News Homepage[10]
Phone: (903) 885-8663
Explored various links and online texts. Nothing significant was found.

The Daily Tribune
The Daily Tribune Homepage[11]
(903) 572-1705
Explored various links and online texts. Nothing significant was found.

Internet Searches:

The Handbook of Texas Online
The Handbook of Texas Online - Search for White Oak Creek[12]
Searched the handbook by river name. Nothing significant was found.

Texas Escapes Online Magazine
Texas Escapes Online Magazine - Search for White Oak Creek[13]
Nothing significant was found.

Texas Parks and Wildlife Department

Information regarding outdoor recreation opportunities within the White Oak WMA was found which included hunting, fishing, wildlife viewing, and hiking.
White Oak WMA[14]

[4] http://www.sulphurspringstx.org/index.php
[5] http://www.mountvernonwa.gov/
[6] http://www.mpcity.net/
[7] http://www.sslibrary.org/
[8] http://www.franklincolibrary.com/
[9] http://www.mpcity.net/library
[10] http://www.myssnews.com/index.php
[11] http://www.dailytribune.net/
[12] http://www.tshaonline.org/
[13] http://www.texasescapes.com/
[14] http://tpwd.texas.gov/huntwild/hunt/wma/find_a_wma/list/?id=35

Chapter 4
White Oak Creek (0303B)

Survey Site Descriptions

White Oak Creek (0303B) is approximately 120 river miles long indicating a goal of 72 sites (3 sites per 5 miles of river) for the RUAA survey. With the help of cooperating stakeholders, TIAER was able to establish a total of 41 survey sites along White Oak Creek (Figure 4.1 and Table 4.1). Thirty-one of the 41 sites were located at public road crossings while 10 sites were accessible via private property. A closer view of the site locations can be seen in Appendix A, Figures A.1 – A.3.

The corridor of White Oak Creek is characterized almost entirely by thick natural forest with dense herbaceous undergrowth. Therefore, access to the channel was limited to breaks in the vegetation primarily at public or pasture-road crossings or, in rare instances, where the creek ran through a cleared pasture. The public access points were unfenced with the exception of WH37, which required landowner permission to cross the fenceline. The unfenced sites allowed free travel by boat when depths permitted. A 20 foot flat-bottomed boat with a 10 hp motor was used to conduct the surveys at 23 sites. Large obstructions such as fallen trees and accumulated flood debris prevented travel in the creek at times.

Six sites were co-located with TCEQ sampling stations. The average distance between sites was 2.97 miles ranging from 0.31 river miles to 12.89 river miles. The largest gap between sites was between sites WH29 and WH30. RUAA surveys were conducted June 22 – 23, July 19 – 22, August 7 – 11 and August 25, 2016. A brief description of each site follows.

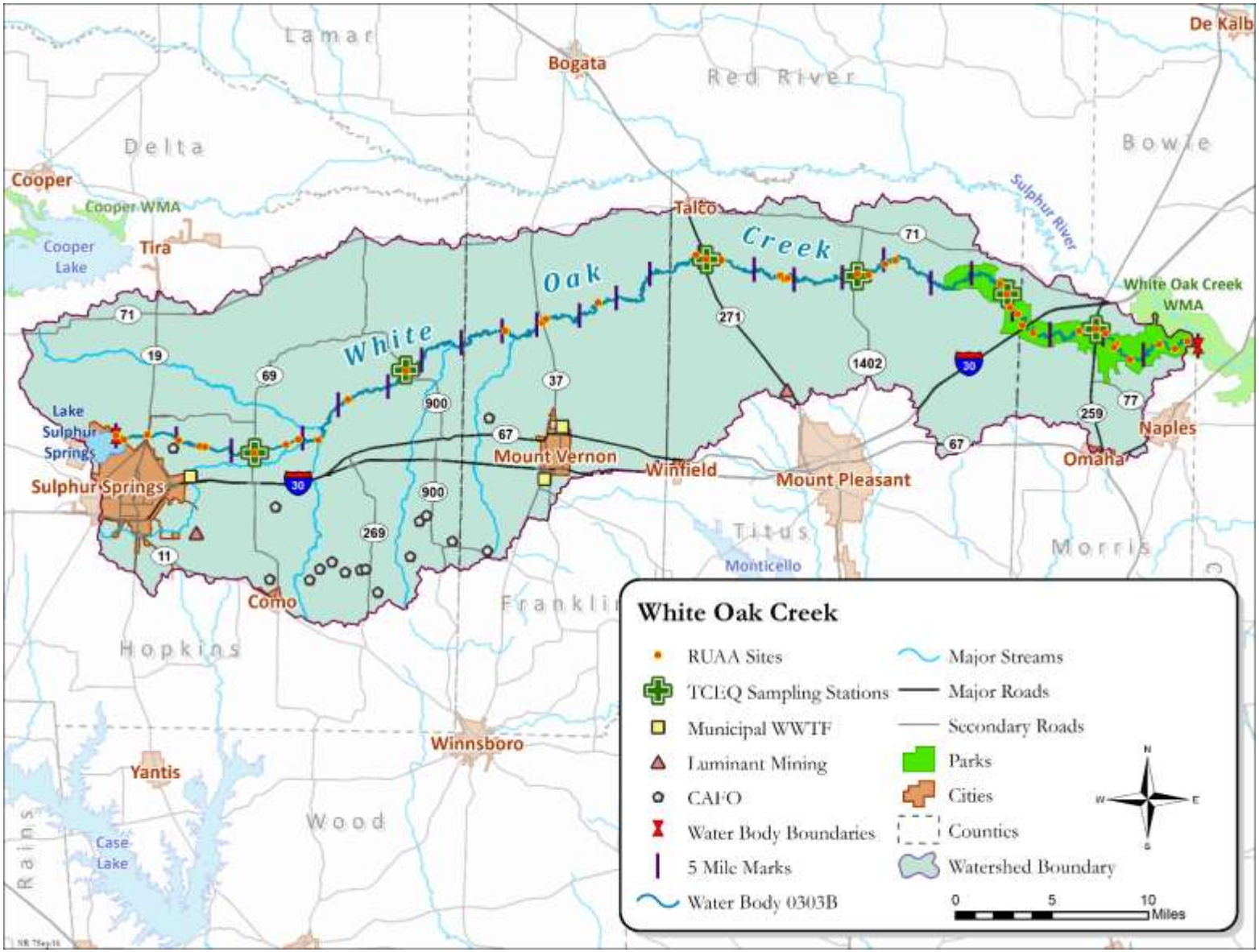

Figure 4.1 Watershed of White Oak Creek (0303B).

Table 4.1 Description and location of RUAA field survey sites for White Oak Creek, Water Body 0303B.

Site ID	TCEQ Station	Site Description	Latitude	Longitude	Distance from Confluence (mi) [1]	Distance from Previous Site (mi)	Access
WH01		White Oak Creek about 1.09 miles from the confluence with the Sulphur River on White Oak Creek Wildlife Management Area	33.267436	-94.659874	1.09	NA	Public
WH02		White Oak Creek about 2.25 miles from the confluence with the Sulphur River on White Oak Creek Wildlife Management Area	33.261746	-94.670954	2.25	1.16	Public
WH03		White Oak Creek about 3.46 miles from the confluence with the Sulphur River on White Oak Creek Wildlife Management Area	33.264756	-94.684989	3.46	1.21	Public
WH04		White Oak Creek about 4.61 miles downstream from State Highway (SH) 259 on White Oak Creek Wildlife Management Area	33.252703	-94.710904	6.09	2.63	Public
WH05		White Oak Creek about 3.36 miles downstream from SH 259 on White Oak Creek Wildlife Management Area	33.261951	-94.725684	7.99	1.90	Public
WH06		White Oak Creek about 2.11 miles downstream from SH 259 on White Oak Creek Wildlife Management Area	33.263947	-94.723664	8.59	0.60	Public
WH07		White Oak Creek about 0.84 mile downstream from SH 259 on White Oak Creek Wildlife Management Area	33.272075	-94.733321	9.86	1.27	Public

Site ID	TCEQ Station	Site Description	Latitude	Longitude	Distance from Confluence (mi) [1]	Distance from Previous Site (mi)	Access
WH08	**10198**	White Oak Creek at SH 259, approximately 7.5 miles north of Omaha, Texas	33.27536	-94.74208	10.70	0.84	Public
WH09		White Oak Creek about 1.81 miles upstream from SH 259 on White Oak Creek Wildlife Management Area	33.273578	-94.757003	11.98	1.28	Public
WH10		White Oak Creek about 6 miles upstream from SH 259 and about 1.04 miles downstream from Interstate Highway 30 on White Oak Creek Wildlife Management Area	33.271589	-94.798303	16.67	4.69	Public
WH11		White Oak Creek at Interstate Highway 30, about 21.8 miles northeast of Mt. Pleasant, Texas	33.277333	-94.808169	17.90	1.23	Public
WH12		White Oak Creek 1.7 miles upstream from Interstate Highway 30 on White Oak Creek Wildlife Management Area	33.285503	-94.812513	19.43	1.54	Public
WH13		White Oak Creek 2.5 miles upstream from Interstate Highway 30 on White Oak Creek Wildlife Management Area	33.290267	-94.819745	20.18	0.75	Public
WH14	**16697**	White Oak Creek at a WMA road crossing about 1.06 miles east of County Road (CR) 3445 and about 3.3 miles upstream from Interstate Highway 30 on White Oak Creek Wildlife Management Area (White Oak Creek off CR NE of I35)	33.300526	-94.82203	21.01	0.83	Public

Site ID	TCEQ Station	Site Description	Latitude	Longitude	Distance from Confluence (mi) [1]	Distance from Previous Site (mi)	Access
WH15		White Oak Creek about 4 miles upstream from Interstate Highway 30 on White Oak Creek Wildlife Management Area	33.308105	-94.828454	21.80	0.79	Public
WH16		White Oak Creek on private property, about 4.2 miles downstream from Farm to Market (FM) 1402	33.324322	-94.922892	34.04	12.25	Private
WH17		White Oak Creek on private property, about 3.46 miles downstream from FM 1402	33.321566	-94.932182	35.38	1.33	Private
WH18		White Oak Creek on private property, about 0.72 mile downstream from FM 1402	33.313244	-94.946892	37.51	2.13	Private
WH19	**21412**	White Oak Creek at Titius County FM 1402	33.312135	-94.957039	38.23	0.72	Public
WH20		White Oak Creek about 0.33 mile downstream from CR 1905	33.309373	-95.019592	46.35	8.12	Public
WH21		White Oak Creek at CR 1905	33.308772	-95.022148	46.68	0.33	Public
WH22		White Oak Creek about 0.44 mile upstream from CR 1905	33.311237	-95.025817	47.12	0.44	Public
WH23		White Oak Creek about 1.3 miles downstream from US Highway 271	33.322083	-95.079082	53.45	6.32	Public
WH24	**10199**[2]	White Oak Creek at US Highway 271	33.322687	-95.092707	54.71	1.27	Public

Site ID	TCEQ Station	Site Description	Latitude	Longitude	Distance from Confluence (mi) [1]	Distance from Previous Site (mi)	Access
WH25		White Oak Creek about 0.76 mile upstream from US Highway 271	33.325546	-95.101859	55.47	0.76	Public
WH26		White Oak Creek at CR 2100	33.288349	-95.188892	67.06	11.59	Public
WH27		White Oak Creek about 0.48 mile downstream from SH 37	33.274986	-95.235207	74.25	7.18	Public
WH28		White Oak Creek at SH 37	33.272477	-95.238465	74.73	0.48	Public
WH29		White Oak Creek on private property about 5.15 miles upstream from SH 37	33.265667	-95.271596	79.88	5.15	Private
WH30	**10201**	White Oak Creek at FM 900	33.234268	-95.360116	92.77	12.89	Public
WH31		White Oak Creek on private property about 6 miles upstream from FM 900	33.211149	-95.411175	98.94	6.17	Private
WH32		White Oak Creek on private property about 4.4 miles downstream from FM 69	33.180110	-95.43669	103.89	4.96	Private
WH33		White Oak Creek on private property about 2.79 miles downstream from FM 69	33.180110	-95.454810	105.51	1.62	Private
WH34		White Oak Creek on private property about 2.1 miles downstream from FM 69	33.176140	-95.46550	106.19	0.69	Private
WH35	**20099**	White Oak Creek at FM 69	33.169560	-95.49360	108.30	2.11	Public

Site ID	TCEQ Station	Site Description	Latitude	Longitude	Distance from Confluence (mi) [1]	Distance from Previous Site (mi)	Access
WH36		White Oak Creek on private property about 0.31 mile downstream from CR 3504	33.172920	-95.537936	112.48	4.18	Private
WH37		White Oak Creek at CR 3504	33.173388	-95.542680	112.79	0.31	Public*
WH38		White Oak Creek on private property about 2.2 miles upstream from CR 3504	33.177261	-95.561811	115.01	2.22	Private
WH39		White Oak Creek at SH 19	33.181152	-95.589948	117.50	2.49	Public
WH40		White Oak Creek on right-of-way about 0.52 mile downstream from FM 2285	33.176947	-95.610735	119.48	1.98	Public
WH41		White Oak Creek at FM 2285	33.179921	-95.617829	120.00	0.52	Public

[1]Distances were digitally estimated using the measuring tool in ArcGIS 10.1 with the 2010 National Agriculture Imagery Program (NAIP) 1-m digital orthophoto quarter quads (DOQQs) and the National Hydrography Dataset (NHD) stream layer as reference guides.

[2]The location of Site WH24 correponds with TCEQ Station 10199, but a new GPS coordinate was taken for WH24 that differs slightly in latitude and longitude from that listed for TCEQ Station 10199 (33.322346, -95.092541).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

Site WH01 is located on White Oak Creek 1.09 miles from the confluence of the Sulphur River. This site is publically accessible but requires boating up the Sulphur River in order to access the site.

Site WH02 is located on White Oak Creek 2.25 miles from the confluence with the Sulphur River. This site is publically accessible but requires boating up the Sulphur River on order to access the site.

Site WH03 is located on White Oak Creek 3.46 miles from the confluence with the Sulphur River. This site is publically accessible but requires boating up the Sulphur River in order to access the site.

Site WH04 is located on White Oak Creek 6.09 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from SH 259 in order to access the site.

Site WH05 is located on White Oak Creek 7.99 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from SH 259 in order to access the site.

Site WH06 is located on White Oak Creek 8.59 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from SH 259 in order to access the site.

Site WH07 is located on White Oak Creek 9.86 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from SH 259 in order to access the site.

Site WH08 is located on White Oak Creek 10.70 miles from the confluence with the Sulphur River at the bridge crossing at SH 259. This site is publically accessible from the bridge crossing, which has a paved parking lot and boat ramp.

Site WH09 is located on White Oak Creek 11.98 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating upstream from the bridge crossing at SH 259.

Site WH10 is located on White Oak Creek 16.67 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from the boat ramp at Hill Hole parking lot within the White Oak Creek WMA.

Site WH11 is located on White Oak Creek 17.9 miles from the confluence with the Sulphur River at the bridge crossing at Interstate 30. This site is publically accessible, requires boating downstream from boat ramp at Hill Hole parking lot within the White Oak Creek WMA for access to the site.

Site WH12 is located on White Oak Creek 19.43 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating downstream from the public boat ramp at Hill Hole parking lot within the White Oak Creek WMA.

Site WH13 is located on White Oak Creek 20.18 miles from the confluence with the Sulphur River at a WMA road. This site is publically accessible, requires boating in order to access the site.

Site WH14 is located on White Oak Creek 21.01 miles from the confluence with the Sulphur River at the Hill Hole parking lot within the White Oak Creek WMA. This site is publically accessible, requires boating in order to access the site.

Site WH15 is located on White Oak Creek 21.79 miles from the confluence with the Sulphur River. This site is publically accessible, requires boating upstream from Hill Hole parking lot within the White Oak Creek WMA in order to access the site.

Site WH16 is located on White Oak Creek 34.04 miles from the confluence with the Sulphur River. This site is located on private property and required landowner permission in order to access the site.

Site WH17 is located on White Oak Creek 35.38 miles from the confluence with the Sulphur River. This site is on private property and required landowner permission in order to access the site.

Site WH18 is located on White Oak Creek 37.51 miles from the confluence with the Sulphur River. This site is on private property and required landowner permission in order to access the site.

Site WH19 is located on White Oak Creek 38.23 miles from the confluence with the Sulphur River at FM 1402 crossing. This site is publically accessible from the road crossing.

Site WH20 is located on White Oak Creek 46.35 miles from the confluence with the Sulphur River. This site is publically accessible from CR 1905, but requires boating downstream to reach the site.

Site WH21 is located on White Oak Creek 46.68 miles from the confluence with the Sulphur River at crossing with 1905. This site is publically accessible from CR 1905.

Site WH22 is located on White Oak Creek 47.12 miles from the confluence with the Sulphur River. Site is publically accessible from the 1905, and requires boating upstream from the 1905 crossing.

Site WH23 is located on White Oak Creek 53.45 miles from the confluence with the Sulphur River. The site is publically accessible, and requires boating downstream from the bridge crossing at US Highway 271.

Site WH24 is located on White Oak Creek 54.71 miles from the confluence with the Sulphur River at crossing with US Highway 271. Site is publically accessible from the crossing at US Highway 271.

Site WH25 is located on White Oak Creek 55.47 miles from the confluence with the Sulphur River. The site is publically accessible, but requires boating upstream from the US Highway 271 crossing.

Site WH26 is located on White Oak Creek 67.06 miles from the confluence with the Sulphur River at the crossing with CR 2100. The site is publically accessible from the crossing at CR 2100.

Site WH27 is located on White Oak Creek 74.25 miles from the confluence with the Sulphur River. The site is publically accessible, and requires boating downstream from SH 37 crossing.

Site WH28 is located on White Oak Creek 74.73 miles from the confluence with the Sulphur River at the crossing with State Highway 37. The site is publically accessible from the SH 37 crossing.

Site WH29 is located on White Oak Creek 79.88 miles from the confluence with the Sulphur River. This site is private property requiring landowner permission in order to access the survey site, which is 5.15 miles upstream from SH 37.

Site WH30 is located on White Oak Creek 92.77 miles from the confluence with the Sulphur River at the crossing with FM 900. This site is publicly accessible from the bridge crossing.

Site WH31 is located on White Oak Creek 98.94 miles from the confluence with the Sulphur River. The site is located 6 miles upstream from FM 69. This site is on private property requiring landowner permission in order to access the survey site.

Site WH32 is located on White Oak Creek 103.89 miles from the confluence with the Sulphur River. This site is on private property and required landowner permission to conduct the survey.

Site WH33 is located on White Oak Creek 105.51 miles from the confluence with the Sulphur River. This site is located on private property, and required gate access in order to complete the survey.

Site WH34 is located on White Oak Creek 106.19 miles from the confluence with the Sulphur River. This site is located on private property, and required landowner permission to go through a gate in order to access the site.

Site WH35 is located on White Oak Creek 108.30 miles from the confluence with the Sulphur River at the crossing with FM 69. This site is publically accessible from the bridge crossing.

Site WH36 is located on White Oak Creek 112.48 miles from the confluence with the Sulphur River. This site is on private property and required landowner permission in order to access the site for the surveys.

Site WH37 is located on White Oak Creek 112.79 miles from the confluence with the Sulphur River at the CR 3504 bridge crossing. This site is publically accessible from the bridge crossing.

Site WH38 is located on White Oak Creek 115.01 miles from the confluence with the Sulphur River. This site is located on private property and required landowner permission in order to access the survey site.

Site WH39 is located on White Oak Creek 117.50 miles from the confluence with the Sulphur River at the crossing with SH 19. This site is publically accessible from the bridge crossing.

Site WH40 is located on White Oak Creek 119.48 miles from the confluence with the Sulphur River. This site is located downstream from the dam at the Sulphur Lake. This site is publically accessible via the right of way off FM 2285.

Site WH41 is located on White Oak Creek 120.00 miles from the confluence with the Sulphur River. This site is located at the crossing with FM 2285 and is publically accessible.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for White Oak Creek 0303B

The White Oak Creek RUAA surveys were conducted during four separate trips. The first set of surveys for sites WH05 – WH17 were conducted June 22 – 23, 2016. The first set of surveys for sites WH01 – WH04 and WH18 – WH41 were conducted July 19-22. The second set of surveys for sites WH08 – WH41 were conducted August 7-11, 2016. Finally, the second set of surveys for sites WH01 – WH07 were conducted August 25, 2016. Surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior to and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 4.2 and 4.3).

Due to the large size of this watershed (737 sq. mi or 471,600 acres) and a water body length of about 120 miles, rainfall and temperature were highly variable. To address this, two weather stations were selected to represent rainfall and temperature data for the Eastern region and the Western region of the watershed. Weather data for the headwaters region of the watershed were retrieved from the Sulphur Springs Municipal Airport, KSLR. Weather conditions for the downstream end of the watershed were retrieved from the Mount Vernon, TX station KTXMOUNT23. In the 30 days prior to the first survey initiated on June 22, 2016, 5.69 inches of precipitation were recorded at Sulphur Springs and 4.16 inches were recorded at Mount Vernon. In the 30 days prior to surveys initiated on July 19, 2016, only 0.05 inches were recorded at Sulphur Springs and 1.17 inches at Mount Vernon. In the 30 days prior to the second survey initiated on August 7, 2016, 0.51 inches of precipitation were recorded at Sulphur Springs and 1.14 inches were recorded at Mount Vernon. For second surveys conducted on August 25, 2016, 0.59 inches were recorded at Sulphur Springs and 6.57 inches at Mount Vernon in the 30 day prior. The Palmer Drought Severity Index (PDSI) represented very moist (+3.00 - +3.99) to extremely moist (+4.00 and above) conditions for Northeast Texas during June through August 2016 (NOAA, Historical Palmer Drought Indices, 2016).

A summary of the RUAA field survey results is presented in the following tables:

- Table 4.5 describes the stream channel and corridor characteristics at each site.
- Table 4.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 4.7 and 4.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 4.9 and 4.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each survey.
- Table 4.11 describes the public access point to each site location

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Sites were selected at public road crossings due to the close proximity of the creek to an area accessible to the public. Sites WH01 though WH15 were established within the White Oak Creek Wildlife Management Area (WMA). A 20ft aluminum flat bottomed boat with a 10 hp motor was used to access sites WH01 – WH15 because flooded/high water conditions existed during both survyes and required boat access. Of the 41 sites established, 5 sites were

inaccessible at the during both surveys. These sites were WH04, WH10, WH23, WH27 and WH29. In addition, sites WH09, WH11, and WH12 were inaccessible during the second survey. Access to these sites was prohibited by combinations of in-stream logjams, debris, steep muddy banks, dense bank vegetation, and lack of any roads leading to the creek near these locations. A total of 36 sites were surveyed. Of these 36 sites, 64% of them were difficult to access, 25% were moderately difficult, 6% were moderately easy, and 6% were easily accessed. Overall thalwegs for sites WH01 through WH15 within the WMA during the first survey were greater than 1.5 m and 1.3 m during the second. The banks were typically steep, slick, and muddy making access directly from the bank very difficult, especially where depths were above the surveyors' waders. Overall thalwegs for sites WH16 through WH41 outside the WMA were 0.85 m during the first survey and 0.78 m during the second. Flows for sites outside the WMA and further upstream from the influence of the Sulphur River appeared normal during both surveys. The dominant substrate for White Oak Creek was mud/clay or, in the more upstream sites, mud/clay with a sand component. The channel's appearance typically represented by a large riparian zone of natural vegetation representing a native bottomland hardwood forest. In general, garbage was scarce. Where trash was encountered, it was primarily glass bottles, aluminum cans and common plastics. Tracks encountered in the stream primarily belonged to wildlife and were largely represented by raccoons and feral hogs. Crayfish burrows were very common. Snakes were regularly encountered, although not at every site. Water Moccasins (*Agkistrodon piscivorous*) and representatives of the *Nerodia* genus were the primary snakes encountered.

Table 4.2 Rainfall records with maximum and minimum temperature for Sulphur Springs, Texas 30 days prior to the first RUAA survey initiated on June 22 and 23, and July 19 – 22, 2016.

Date	Sulphur Springs Daily Precip (in)	Mount Vernon Daily Precip (in)	Sulphur Springs Max Daily Temp (°F)	Mount Vernon Max Daily Temp (°F)	Sulphur Springs Min. Daily Temp (°F)	Mount Vernon Min. Daily Temp (°F)
23-May-16	0.17	0.1	85	84	65	65
24-May-16	0	0	86	86	71	67
25-May-16	0	0	89	90	75	74
26-May-16	0.08	0.13	80	79	70	67
27-May-16	0.14	0.27	73	71	67	65
28-May-16	0	0	82	82	66	64
29-May-16	0	0	89	89	71	68
30-May-16	0.56	0.12	83	84	67	67
31-May-16	2.14	2.03	88	88	67	67
1-Jun-16	0.11	0.3	79	78	66	67
2-Jun-16	0.34	0.22	74	75	69	70
3-Jun-16	0.02	0.2	80	80	69	69
4-Jun-16	0.83	0.36	84	83	66	67

Date	Sulphur Springs Daily Precip (in)	Mount Vernon Daily Precip (in)	Sulphur Springs Max Daily Temp (°F)	Mount Vernon Max Daily Temp (°F)	Sulphur Springs Min. Daily Temp (°F)	Mount Vernon Min. Daily Temp (°F)
5-Jun-16	0	0.01	88	87	67	63
6-Jun-16	0	0	88	88	66	64
7-Jun-16	0.04	0.03	91	90	67	63
8-Jun-16	0	0	92	92	68	65
9-Jun-16	0	0	92	92	69	67
10-Jun-16	0	0	92	91	71	69
11-Jun-16	0	0	91	91	70	70
12-Jun-16	0.59	0.26	88	92	70	71
13-Jun-16	0.67	0.13	83	87	72	72
14-Jun-16	0	0	91	92	73	74
15-Jun-16	0	0	91	91	77	76
16-Jun-16	0	0	94	95	77	76
17-Jun-16	0	0	94	94	76	72
18-Jun-16	0	0	95	95	74	73
19-Jun-16	0	0	91	90	73	71
20-Jun-16	0	0	92	90	74	71
21-Jun-16	0	0	95	94	76	73
22-Jun-16	0	0	93	93	77	75
23-Jun-16	0	0	93	93	77	75
24-Jun-16	0	0	93	93	76	74
25-Jun-16	0	0	94	95	77	72
26-Jun-16	0	0	93	96	78	74
27-Jun-16	0.01	0.03	96	96	76	73
28-Jun-16	0	0	93	91	75	72
29-Jun-16	0	0	93	93	72	71
30-Jun-16	0	0	94	93	70	70
1-Jul-16	0	0	95	95	71	68
2-Jul-16	0	0	94	94	77	71
3-Jul-16	0	0	95	96	78	77
4-Jul-16	0.04	0	90	89	75	77
5-Jul-16	0	0	94	93	79	76
6-Jul-16	0	0	96	97	78	76
7-Jul-16	0	0	96	97	78	77
8-Jul-16	0	0	95	96	77	74
9-Jul-16	0	0	91	92	76	78

Date	Sulphur Springs Daily Precip (in)	Mount Vernon Daily Precip (in)	Sulphur Springs Max Daily Temp (°F)	Mount Vernon Max Daily Temp (°F)	Sulphur Springs Min. Daily Temp (°F)	Mount Vernon Min. Daily Temp (°F)
10-Jul-16	0	0.07	93	92	75	73
11-Jul-16	0	0	95	94	77	72
12-Jul-16	0	0	94	95	78	77
13-Jul-16	0	0	96	97	77	73
14-Jul-16	0	0	97	98	77	74
15-Jul-16	0	1.07	89	92	75	70
16-Jul-16	0	0	97	95	72	70
17-Jul-16	0	0	96	95	77	72
18-Jul-16	0	0	95	95	78	73
19-Jul-16	0	0	96	95	75	73
20-Jul-16	0	0	97	97	79	75
21-Jul-16	0	0	98	98	79	74
22-Jul-16	0	0	99	100	78	74

Survey dates are highlighted in gray. Weather Data obtained from Weather Underground for Sulphur Springs, TX, station ID KSLR at the Municipal Airport in Sulphur Springs, TX and Mount Vernon, TX, station ID KTXMOUNT23.

Table 4.3 Rainfall records with maximum and minimum temperature for Sulphur Springs, Texas 30 days prior to the second RUAA survey initiated on August 7 - 11, and August 25, 2016.

Survey dates are highlighted in gray. Weather Data from Weather Underground; station KSLR at the Municipal Airport in Sulphur Springs, TX.

Date	Sulphur Springs Daily Precip (in)	Mount Vernon Daily Precip (in)	Sulphur Springs Max Daily Temp (°F)	Mount Vernon Max Daily Temp (°F)	Sulphur Springs Min. Daily Temp (°F)	Mount Vernon Min. Daily Temp (°F)
8-Jul-16	0	0	95	96	77	74
9-Jul-16	0	0	91	92	76	78
10-Jul-16	0	0.07	93	92	75	73
11-Jul-16	0	0	95	94	77	72
12-Jul-16	0	0	94	95	78	77
13-Jul-16	0	0	96	97	77	73
14-Jul-16	0	0	97	98	77	74
15-Jul-16	0	1.07	89	92	75	70
16-Jul-16	0	0	97	95	72	70
17-Jul-16	0	0	96	95	77	72
18-Jul-16	0	0	95	95	78	73
19-Jul-16	0	0	96	95	75	73
20-Jul-16	0	0	97	97	79	75
21-Jul-16	0	0	98	98	79	74
22-Jul-16	0	0	99	100	78	74
23-Jul-16	0	0	100	100	78	75
24-Jul-16	0	0	98	99	77	73
25-Jul-16	0.19	0	97	96	75	74
26-Jul-16	0	0	96	96	75	73
27-Jul-16	0.29	0	95	97	75	73
28-Jul-16	0.03	0	93	89	75	71
29-Jul-16	0	0	94	95	75	71
30-Jul-16	0	0	97	98	74	70
31-Jul-16	0	0	98	97	77	72
1-Aug-16	0	0	97	99	78	76
2-Aug-16	0	0	99	99	77	71
3-Aug-16	0	0	100	100	78	73
4-Aug-16	0	0	100	100	79	75
5-Aug-16	0	0	100	101	78	74
6-Aug-16	0	0	100	101	79	77

Date	Sulphur Springs Daily Precip (in)	Mount Vernon Daily Precip (in)	Sulphur Springs Max Daily Temp (°F)	Mount Vernon Max Daily Temp (°F)	Sulphur Springs Min. Daily Temp (°F)	Mount Vernon Min. Daily Temp (°F)
7-Aug-16	0	1.25	100	100	77	74
8-Aug-16	0	0.18	100	96	76	71
9-Aug-16	0	0	100	97	76	74
10-Aug-16	0	0	101	99	75	74
11-Aug-16	0	0	101	100	80	77
12-Aug-16	0	0	102	102	79	74
13-Aug-16	0.11	0.13	94	89	77	75
14-Aug-16	0.04	0	86	85	76	75
15-Aug-16	0.04	2.22	77	75	71	71
16-Aug-16	0.01	0.18	79	78	72	72
17-Aug-16	0.01	0.84	81	79	73	72
18-Aug-16	0	0.9	85	81	73	72
19-Aug-16	0	0.48	87	86	74	73
20-Aug-16	0	0.05	79	81	73	73
21-Aug-16	0.01	0	85	84	70	73
22-Aug-16	0.05	0.27	83	87	72	72
23-Aug-16	0	0	91	92	75	71
24-Aug-16	0	0	92	93	75	74
25-Aug-16	0	0.07	93	93	76	74

Survey dates are highlighted in gray. Weather Data from Weather Underground; station KSLR at the Municipal Airport in Sulphur Springs, TX.

Table 4.5 Stream channel and corridor appearance for each site sampled along White Oak Creek (0303B).

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
WH01	Natural	Mud/Clay	Forest	Large	WMA[1]	Native
WH02	Natural	Mud/Clay	Forest	Large	WMA	Native
WH03	Natural	Mud/Clay	Forest	Large	WMA	Native
WH04	Natural	NA[2]	Forest	Large	WMA	Native
WH05	Natural	Mud/Clay	Forest	Large	WMA	Native
WH06	Natural	Mud/Clay	Forest	Large	WMA	Native
WH07	Natural	Mud/Clay	Forest	Large	WMA	Native
WH08	Natural	Mud/Clay	Forest/Mowed	Large	WMA	Native
WH09	Natural	Mud/Clay	Forest	Large	WMA	Native
WH10	Natural	NA	Forest	Large	WMA	Native
WH11	Natural	Mud/Clay	Forest	Large	WMA	Native
WH12	Natural	Mud/Clay	Forest	Large	WMA	Native
WH13	Natural	Mud/Clay	Forest	Large	WMA	Native

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
WH14	Natural	Mud/Clay	Forest	Large	WMA	Native
WH15	Natural	Mud/Clay	Forest	Large	WMA	Native
WH16	Natural	Mud/Clay	Forest	Large	No	Native
WH17	Natural	Mud/Clay	Forest/Pasture	Large	No	Native/Improved Pasture
WH18	Natural	Mud/Clay	Forest	Large	No	Native
WH19	Natural	Sand	Forest	Large	No	Native
WH20	Natural	Sand	Forest	Large	No	Native
WH21	Natural	Mud/Clay	Forest	Large	No	Native
WH22	Natural	Mud/Clay	Forest/Pasture	Large	No	Native
WH23	N/A	N/A	N/A	N/A	No	N/A
WH24	Natural	Mud/Clay	Forest	Large	No	Native
WH25	Natural	Sand/Mud/Clay	Forest	Large	No	Native
WH26	Natural	Sand/Silt/Mud/Clay	Forest	Large	No	Native
WH27	NA	NA	NA	NA	No	NA

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
WH28	Natural	Sand/Silt/Mud/Clay	Forest	Large	No	Native
WH29	Natural	NA	NA	Large	No	Native
WH30	Natural	Mud/Clay	Forest/Mowed/Maintained Corridor	Large	No	Native
WH31	Natural	Mud/Clay	Forest	Large	No	Native
WH32	Natural	Mud/Clay	Forest	Large	No	Native
WH33	Natural	Sand/Mud/Clay	Forest/Pasture	Large	No	Native
WH34	Natural	Sand/Mud/Clay	Forest/Pasture	Large	No	Native/Improved Pasture
WH35	Natural	Sand/Mud/Clay	Forest	Large	No	Native
WH36	Natural	Sand/Mud/Clay	Forest/Pasture	Large	No	Native/Improved Pasture
WH37	Natural	Mud/Clay/Riprap/Concrete	Forest/Pasture	Large	No	Native/Improved Pasture
WH38	Natural	Sand/Mud/Clay	Forest	Large	No	Native
WH39	Natural	Mud/Clay	Forest	Large	No	Native
WH40	Natural	Sand/Mud/Clay	Forest	Large	No	Native
WH41	Natural	Mud/Clay/Rip Rap/Concrete	Forest	Large	No	Native

[1] WMA indicates within the White Oak Wildlife Management Area.
[2] NA indicates not applicable as site was inaccessible during survey.

Table 4.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of White Oak Creek (0303B).

Stream flow type represents stream characteristics as assessed on the date of the survey. Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult. NA indicates not applicable as site was inaccessible during the survey.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type (First Survey)	Stream Flow Type (Second Survey)	General Access	Bank Access
WH01	300	11	0	>1.5	>1.5	Intermittent	Intermittent	Public	D
WH02	300	11	0	>1.5	>1.5	Intermittent	Intermittent	Public	D
WH03	300	11	0	>1.5	>1.5	Intermittent	Intermittent	Public	D
WH04	NA	NA	0	NA	NA	NA	NA	NA	NA
WH05	300	11	0	>1.5	>1.5	Intermittent	Perennial Pools	Public	D
WH06	300	11	0	>1.5	>1.5	Intermittent	Perennial Pools	Public	D
WH07	300	11	0	>1.5	>1.5	Intermittent	Perennial Pools	Public	MD
WH08	300	11	0	>1.5	1.1	Perennial	Perennial	Public	ME
WH09	300	11	0	>1.5	NA	Intermittent	Perennial Pools	Public	MD
WH10	NA	NA	0	NA	NA	NA	NA	NA	NA
WH11	300	11	0	>1.5	NA	Perennial	Perennial	Public	D

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type (First Survey)	Stream Flow Type (Second Survey)	General Access	Bank Access
WH12	300	11	0	>1.5	NA	Perennial	Perennial	Public	D
WH13	300	11	0	>1.5	>1.5	Perennial	Perennial	Public	D
WH14	300	11	0	>1.5	0.97	Perennial	Perennial	Public	ME
WH15	300	11	0	>1.5	0.76	Perennial	Perennial	Public	MD
WH16	300	11	0	>1.5	1.2	Perennial	Perennial	Private	D
WH17	300	11	0	>1.5	0.71	Perennial	Perennial	Private	D
WH18	300	11	0	0.69	0.73	Intermittent	Intermittent	Private	D
WH19	300	11	0	1.1	0.95	Intermittent	Intermittent	Public	E
WH20	300	11	0	0.21	0.24	Intermitted	Intermittent	Public	D
WH21	300	11	0	1.2	1.0	Intermittent	Intermittent	Public	D
WH22	300	11	0	1.08	1.3	Intermittent	Intermittent	Public	D
WH23	NA	NA	0	NA	NA	NA	NA	NA	NA
WH24	300	11	0	>1.5	1.5	Intermittent	Intermittent	Public	D
WH25	150	6	0	1.4	1.3	Intermittent	Intermittent	Public	D
WH26	300	11	0	0.79	0.71	Intermittent	Intermittent	Public	D

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type (First Survey)	Stream Flow Type (Second Survey)	General Access	Bank Access
WH27	NA	NA	0	NA	NA	NA	NA	NA	NA
WH28	300	11	0	0.76	0.77	Intermittent	Intermittent	Public	D
WH29	NA	NA	0	NA	NA	NA	NA	NA	NA
WH30	300	11	0	0.92	0.85	Intermittent	Perennial Pools	Public	E
WH31	300	11	0	0.43	0.39	Intermittent	Intermittent	Private	D
WH32	300	11	0	0.65	0.67	Intermittent	Intermittent	Private	D
WH33	300	11	0	0.65	0.51	Intermittent	Intermittent	Private	D
WH34	300	11	0	0.83	0.64	Intermittent	Intermittent	Private	D
WH35	300	11	0	0.55	0.64	Intermittent	Intermittent	Public	MD
WH36	300	11	0	0.61	0.69	Intermittent	Intermittent	Private	MD
WH37	300	11	0	0.83	0.73	Intermittent	Intermittent	Public*	MD
WH38	300	11	0	0.31	0.34	Intermittent	Intermittent	Private	MD
WH39	300	11	0	0.69	0.71	Intermittent	Intermittent	Public	MD
WH40	300	11	0	0.94	0.86	Intermittent	Intermittent	Public	MD
WH41	300	11	0	0.43	0.41	Intermittent	Intermittent	Public	D

Table 4.7 Description of surveyed stream sites along White Oak Creek during first survey performed June 22-23, 2016 and July 19-22, 2016.

Due to flooding conditions, width measuresments represent only the observerable width and were likely greater in many cases as the true width was obscured as the water level had risen above the banks into the understory vegetation.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
WH01	70	6	40	Flooded
WH02	74	25	55	Flooded
WH03	58	31	35	Flooded
WH04	NA[1]	NA	NA	NA
WH05	51	30	NA	Flooded
WH06	70	20	37	Flooded
WH07	30	15	30	Flooded
WH08	44	28	29	High
WH09	33	22	25	High
WH10	NA	NA	NA	NA
WH11	22	17	21	High
WH12	39	23	34	High
WH13	26	12	14	High
WH14	26	16	16	High
WH15	19	11	14	High
WH16	25	15	19	High
WH17	15	12	13	High
WH18	14	6	9	Normal
WH19	15	5	12	Normal
WH20	4	2	3	Normal
WH21	23	7	14	Normal
WH22	21	10	12	Normal
WH23	NA	NA	NA	NA
WH24	38	12	30	Normal
WH25	25	13	14	Normal
WH26	10	1.5	3.5	Normal
WH27	NA	NA	NA	NA
WH28	12	2	10	Normal
WH29	NA	NA	NA	NA
WH30	18	13	16	Normal
WH31	10	4	9	Normal

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
WH32	12	7	10	Normal
WH33	10	3	9	Normal
WH34	12	4	10	Normal
WH35	9	1.4	8	Normal
WH36	11	2	3.5	Normal
WH37	16	2	4	Normal
WH38	7	1.4	5	Normal
WH39	10	4	8	Normal
WH40	16	4	11	Normal
WH41	20	3	3.5	Normal

[1] NA indicates not applicable as the site was inaccessible during the survey.

Table 4.8 Description of surveyed stream sites along White Oak Creek during second survey performed in August 7-11 and August 25, 2016.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
WH01	15	4	12	High
WH02	8.2	3.7	7	High
WH03	6	4.5	5	High
WH04	NA[1]	NA	NA	NA
WH05	35	18	30	High
WH06	20	12	17	High
WH07	32	19	22	High
WH08	33	28	30	High
WH09	NA	NA	NA	NA
WH10	NA	NA	NA	NA
WH11	NA	NA	NA	NA
WH12	NA	NA	NA	NA
WH13	26	12	14	High
WH14	26	16	16	High
WH15	19	11	14	High
WH16	20	9	10	High
WH17	16	9	12	Normal
WH18	14	6	9	Normal
WH19	15	5	11	Normal
WH20	4	2	3	Normal

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
WH21	23	10	19	Normal
WH22	30	9	18	Normal
WH23	NA	NA	NA	NA
WH24	39	17	23	Normal
WH25	25	12	20	Normal
WH26	10	5	6	Normal
WH27	NA	NA	NA	NA
WH28	12	1.5	10	Normal
WH29	NA	NA	NA	NA
WH30	18	13	16	Normal
WH31	9	3	8	Normal
WH32	12	7	10	Normal
WH33	10	3	9	Normal
WH34	13	8	11	Low
WH35	8.2	3	6	Low
WH36	11	1.6	3.5	Normal
WH37	16	2.3	4.5	Normal
WH38	10	1.4	5	Normal
WH39	10	2.5	8	Normal
WH40	17	4	11	Normal
WH41	20	0.6	3.5	Normal

[1] NA indicates not applicable as the site was inaccessible during the survey.

Table 4.9 Stream aesthetics along White Oak Creek during first survey performed in June 22-23 and July 19 - 22, 2016.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = Slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as site was inaccessible during survey.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH01	Ab	R	R	Clear	Fine sediment	Debris	SP	SP	N	Tracks/Fecal	N	R	N
WH02	Ab	R	R	Clear	Fine sediment	Debris	N	SP	N	Fecal Droppings	N	R	N
WH03	Ab	A	R	Clear	Fine sediment	Debris	SP	SP	N	Fecal Droppings	N	R	N
WH04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH05	Ab	R	N	Brown	Fine sediment	Debris	SP	SP	N	N	N	R	N
WH06	C	A	N	Brown	Fine sediment	Clear	N	SP	N	N	N	N	N
WH07	C	A	N	Brown	Fine sediment	Clear	N	SP	N	N	N	N	N
WH08	R	A	N	Brown	Fine sediment	Clear	N	SP	N	Tracks	N	R	R
WH09	A	A	N	Brown	Fine sediment	Clear/Debris	N	N	N	Tracks	N	R	N
WH10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH11	A	A	N	Brown	Fine sediment	Clear	LP	SP	N	Tracks	N	N	N
WH12	A	A	N	Brown	Fine sediment	Clear	SP	SP	N	Tracks	N	N	N
WH13	A	A	N	Brown	Fine sediment	Clear	SP	SP	N	Tracks/Fecal	N	N	N
WH14	A	A	N	Brown	Fine sediment	Clear	MP	SP	N	Tracks	N	N	N
WH15	A	A	N	Brown	Fine sediment	Clear	MP	SP	SP	Tracks	N	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH16	A	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	R
WH17	A	A	N	Brown	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	N	N
WH18	A	A	R	Brown	Fine sediment/sludge	Clear	SP	SP	N	Tracks/Fecal	R	R	N
WH19	A	A	N	Brown	Fine Sediment/Other	Clear	SP	N	N	Tracks	R	R	R
WH20	A	R	N	Brown	Fine sediments/Logs	Scum	N	SP	N	Tracks	R	C	R
WH21	A	R	N	Brown	Fine sediment	Scum/Foam/Debris	SP	SP	N	Bird Nest	R	R	N
WH22	A	R	N	Brown	Fine sediment	Debris	N	N	N	Tracks/Fecal	N	N	N
WH23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH24	C	R	N	Brown	Fine sediment	Debris/Foam/Scum	N	N	N	Tracks	N	R	N
WH25	A	A	N	Clear	Fine sediment	Clear	N	N	N	N	N	N	N
WH26	A	A	C	Brown	Fine sediment/Sludge	Foam	SP	SP	SP	Tracks/Fecal	Ab	C	R
WH27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH28	A	R	C	Brown	Fine sediment/Sludge	Debris/Foam/Scum	SP	SP	N	Tracks/Fecal	N	R	R
WH29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH30	A	R	R	Brown	Fine sediments	Debris/Foam/Scum	SP	N	N	Tracks/Fecal	N	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH31	A	A	R	Brown	Fine sediment	Debris	SP	N	N	Tracks/Fecal	N	R	N
WH32	A	R	R	Brown	Fine sediment	Debris	SP	N	N	Tracks/Fecal	N	R	N
WH33	A	R	R	Brown	Fine Sediment	Debris	SP	N	N	Bird nest/Tracks/Fecal	N	R	N
WH34	A	R	N	Brown	Fine sediment	Debris	N	N	N	Tracks/Fecal	N	N	N
WH35	A	A	N	Brown	Fine Sediment	Clear	SP	N	N	Birds Nest/Tracks/Fecal Droppings	R	N	R
WH36	A	A	N	Brown	Fine sediment/Sludge	Clear	N	N	N	Tracks	R	N	N
WH37	A	A	N	Brown	Fine sediment/sludge	Debris/Foam	SP	N	SP	Tracks/Fecal	R	R	N
WH38	A	R	N	Brown	Fine sediment	Clear/Foam	SP	N	N	Tracks	R	R	N
WH39	A	R	N	Brown	Fine sediment/sludge	Debris/Foam	SP	N	N	Tracks/Fecal	N	R	N
WH40	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
WH41	C	R	N	Brown	Fine sediment/Solids	Foam	N	N	N	Tracks/Fecal	R	R	N

Table 4.10 Stream aesthetics along White Oak Creek during second survey performed in August 7 – 11 and August 25, 2016.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = Slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as site was inaccessible during survey.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH01	C	R	R	Clear	Fine Sediment	Debris	N	SP	N	Fecal Droppings	N	N	N
WH02	A	A	R	Clear	Fine Sediment	Debris	N	SP	N	Fecal Droppings	N	N	N
WH03	A	A	R	Clear	Fine Sediment	Debris	N	N	N	Fecal Droppings	N	N	N
WH04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH05	A	R	N	Brown	Fine Sediment	Debris	N	N	N	N	N	N	N
WH06	C	A	N	Brown	Fine Sediment	Debris	N	SP	N	Bird Nest	N	N	N
WH07	C	A	N	Brown	Fine Sediment	Clear	N	SP	N	N	N	N	N
WH08	R	A	N	Brown	Fine Sediment	Clear	MP	N	N	N	N	R	N
WH09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH13	A	A	N	Brown	Fine Sediment	Clear/Scum/Foam	N	N	N	N	N	N	N
WH14	A	A	N	Brown	Fine Sediment	Clear	N	N	N	N	N	N	N
WH15	C	R	N	Brown	Fine Sediment	Foam/Scum	SP	N	N	Bird Nest	N	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH16	A	A	N	Brown	Fine Sediment	Clear	N	N	SP	Fecal Droppings/Tracks	N	N	R
WH17	A	A	N	Brown	Fine Sediment	Clear	N	N	N	N	N	N	N
WH18	A	A	N	Brown	Fine Sediment	Clear	N	N	SP	N	N	N	N
WH19	A	A	R	Brown	Fine Sediment	Debris/Scum/Clear	SP	N	N	Tracks	R	R	R
WH20	A	R	N	Brown	Fine Sediment	Clear	N	N	N	Tracks	N	R	N
WH21	A	R	N	Brown	Fine Sediment	Foam/Scum/Debris	N	N	N	Bird Nest	R	R	N
WH22	A	A	N	Brown	Fine Sediment	Clear	N	N	N	N	N	R	N
WH23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH24	C	R	N	Brown	Fine Sediment	Debris/Clear	N	N	N	N	N	N	N
WH25	A	A	N	Brown	Fine Sediment	Foam/Scum	N	N	N	N	N	N	N
WH26	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks	C	C	R
WH27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH28	A	R	C	Brown	Fine Sediment	Foam/Debris/Scum	N	N	N	N	N	R	R
WH29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WH30	A	A	N	Brown	Fine Sediment	Clear	SP	N	N	N	N	N	R
WH31	A	A	R	Brown	Fine Sediment	Debris	LP	N	N	Tracks/Fecal Droppings	N	R	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WH32	R	R	R	Brown	Fine Sediment	Debris/Scum/Clear/Foam	SP	N	N	Fecal Droppings	N	N	N
WH33	A	A	C	Brown	Sludge	Clear	SP	N	SP	Tracks	N	N	N
WH34	C	A	N	Brown	Fine Sediment	Debris/Clear	N	N	N	Tracks/Fecal Droppings	N	N	N
WH35	A	R	N	Brown	Sludge/Fine Sediments	Scum/Debris/Foam	SP	N	N	Bird Nest/Fecal droppings/Tracks	R	R	R
WH36	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Burrow	N	C	R
WH37	A	A	C	Brown	Fine Sediment	Clear	SP	N	N	N	Ab	Ab	C
WH38	A	R	N	Brown	Fine Sediment	Foam/Scum/Clear	N	N	N	N	N	R	N
WH39	A	A	N	Brown	Sludge/Fine Sediments	Clear	SP	N	SP	Tracks	R	R	N
WH40	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	N	N	N
WH41	C	R	N	Brown	Solids/Fine Sediments	Foam	N	N	N	Tracks/Fecal Droppings	R	R	N

Physical Descriptions:

Because water levels were fairly deep during both surveys, all sites were surveyed by boat. Sites WH01 – WH15, located within the White Oak Creek Wildlife Management Area, . were accessible from three boat launch locations; US Hwy 67 at the Sulphur River crossing, US Hwy 259 at the crossing of White Oak Creek at Site WH08, and the Hill Hole bridge crossing within the WMA at Site WH14. Other sites were accessed as noted in Table 4.11. The road crossing located at IH-30 did have a paved shoulder, however was not used for accessing the creek because high-speed, high-density, including 18-wheelers, traffic both east and westbound posed significant safety concerns. There were also road construction crews and machinery working on the IH-30 bridge during the survey timeframes. As noted earlier, five sites (WH04, WH10, WH23, WH27, and WH29) were not accessible because debris in the channel prohibited travel to them by boat. Additionally, steep, muddy banks, flooded conditions and dense bank vegetation hindered access to these sites. During the second survey, Site WH09 was inaccessible due to water levels too low for boating, and Sites WH11 and WH12 were inaccessible due a log jam that was not present during the first survey.

Table 4.11 Access points for public site locations on White Oak Creek (0303B).

Sites	Access Point
WH01 - WH03	Sulphur River via US Hwy 67
WH04 - WH09	US Hwy 259
WH10 - WH15	Hill Hole WMA road crossing
WH16 - WH18	Private Property
WH19	FM 1402
WH20 - WH22	FM 2152/CR 1905
WH32 - WH25	US Hwy 271
WH26	CR 2100
WH27 - WH28	SH 37
WH29	Private Property
WH30	FM 900
WH31 - WH34	Private Property
WH35	FM 69
WH36	Private Property
WH37	CR 3504
WH38	Private Property
WH39	SH 19
WH40	Right of way off FM 2285
WH41	FM 2285

Physical Description of sites WH01 – WH03

White Oak Creek Sites WH01 – WH03 were visited on July 19 and August 25, 2016. These sites all shared the same access point located at a public boat launch where US Hwy 69 crosses over the Sulphur River. A 2.5 mile boat trip (about 20 minutes) upstream on the Sulphur River, encountering submerged and floating debris, made access to these sites difficult. During the first survey, the observed flow was categorized as flooded (Table 4.7); therefore water levels of the Sulphur River and White Oak Creek came up to the canopies of understory trees. Although a GPS unit was used to navigate to the confluence of White Oak Creek with the Sulphur River, the main channel of White Oak Creek was difficult to find because the opening to the channel between lower vegetation was submerged. During the second survey, however, observed flow was high (Table 4.8) and locating the confluence was easy because water levels were returning to near-normal conditions. Navigating the Sulphur River and White Oak Creek during the second survey was more hazardous due to lower water levels and frequent encounters with submerged debris. Also during the second survey, a stiff current was encountered on White Oak Creek resulting from a steady draw down of the Sulphur River as water was being released out of Lake Wright-Patman. Banks along this stretch of White Oak Creek were steep and about 1 m high in places.

Physical Description site WH01

Site WH01 was located 1.09 miles from the confluence with the Sulphur River. Thalwegs during both surveys were greater than 1.5 m (Table 4.6). During the first survey the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range. A definitive width measurement was not possible; therefore, width measurements were recorded as greater than the greatest observable distance of water between left and right banks. During the first survey, the greatest observable width was 70 m, the narrowest was 6 m with an estimated typical width of 40 m (Table 4.7). During the second survey, the creek was back down into its channel. Widths ranged from 15 m to 4 m with a typical observed width of 12 m (Table 4.8). Bank access was unattainable during the first survey as the banks were submerged and the canopy of understory trees blocked any travel to the edge of the water. During the second survey, however, the banks were visible more frequently. The banks had a slight slope to them and were extremely muddy and slick. Bank vegetation was thick in places prohibiting access to the banks and represented primarily by buttonbush (*Cephalanthus occidentalis*).

The primary substrate seemed to be mud/clay with fine sediment bottom deposit (Table 4.5). During the first survey, aquatic vegetation was abundant, primarily in the form of duckweed as can be seen in Figure 4.2. However, during the second survey, aquatic vegetation was still common but not nearly as copious as in the previous survey (Figure 4.3). During both surveys, the water color was clear with some floating and submerged debris while algae cover and odor remained rare.

Figure 4.2 Photograph of White Oak Creek Site WH01 taken on July 19, 2016. The downstream view of the 150-m transect.

Wildlife observed included egrets, great blue heron, turtles, and fish. Evidence of wildlife included a feather in the water, bird droppings, and hog tracks on the banks. Minimal garbage was observed at this site. During the first survey, only small garbage in the channel was observed in the form of floating glass bottles. No garbage was observed during the second survey.

Figure 4.3 Photograph of White Oak Creek Site WH01 taken on August 25, 2016. The downstream view of the 150-m transect.

During the first survey when water levels allowed boating in the canopy of small trees, TIAER personnel observed some tree limbs had been cut, seemingly to facilitate passage further upstream though the dense vegetation. During the second survey, TIAER personnel encountered the local game warden boating along the same stretch of creek between sites WH01 and WH03. Conversation with the individual confirmed the use of this stretch of creek for fishing. No recreational activities were observed at this site, although some fishing tackle was observed.

Physical Description of WH02

Site WH02 was located 2.25 miles from the confluence with the Sulphur River. Thalwegs during both surveys were greater than 1.5 m (Table 4.6). During the first survey, the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range at 8 of the 11 transects. Where a definitive width measurement was not possible, width measurements were recorded as greater than (>) the greatest visible distance of water between left and right banks. During the first survey, the greatest observable width estimated was 74 m, the narrowest was 25 m with an estimated typical width of 55 m (Table 4.7). During the second survey, the creek was back down into its channel. Widths ranged from 8.2 m to 3.7 m with a typical observed width of 7 m (Table 4.8). Bank access was unattainable during the first survey as the banks were submerged and the canopy of the understory trees blocked any travel to the edge of the water. During the second survey, however, the banks were visible more frequently. The banks had a slight slope to them and were extremely muddy and slick. Bank vegetation was thick in most places prohibiting access to the banks and was mostly comprised of buttonbush (*Cephalanthus occidentalis*).

The primary substrate seemed to be mud/clay with fine sediment bottom deposit (Tables 4.5 and 4.9). During the first survey aquatic, vegetation was abundant, primarily in the form of duckweed as can be seen in Figure 4.4. During the second survey, aquatic vegetation was absent (Figure 4.5) Algae cover was rare during the first survey and absent during the second. The water color was clear with some floating and submerged debris and odor remained rare during both surveys.

Figure 4.4 Photograph of White Oak Creek Site WH02 taken on July 19, 2016. The upstream view of the 150-m transect. TIAER personnel in photo.

Wildlife observed included song birds, great blue heron, turtles, and fish. Evidence of wildlife included bird droppings and a hog wallow on the banks. Minimal garbage was observed at this site. During the first survey, only small garbage in the channel was observed in the form of floating glass bottles. No garbage was observed during the second survey.

Figure 4.5 Photograph of White Oak Creek Site WH02 taken on August 25, 2016. The upstream view of the 150-m transect. TIAER personnel in photo.

During the first survey when water levels enabled boating in the canopy of small trees, TIAER personnel observed some tree limbs had been cut, seemingly to facilitate passage further upstream though the dense vegetation. Additionally, trotlines were observed hanging from tree limbs. During the second survey, TIAER personnel encountered the local game warden boating along the same stretch of creek between sites WH01 and WH03. Conversation with the individual confirmed the use of this stretch of creek for fishing. No recreational activities were observed at this site.

Physical Description of WH03

Site WH03 was located 3.46 miles from the confluence with the Sulphur River. Thalwegs during both surveys were greater than 1.5 m (Table 4.6). During the first survey the greatest width was 58 m, the narrowest was 31 m with an estimated typical width of 35 m (Tables 4.7 and 4.8). During the second survey widths ranged from 6 m to 4.5 m with a typical observed width of 5 m. Bank access was unattainable during the first survey as they were submerged and the canopy of understory trees blocked any travel to the edge of the water. During the second survey, however, the banks were visible more frequently. The banks had a slight slope to them and were extremely muddy and slick. Bank vegetation was thick in most places prohibiting access to the banks and was mostly covered in button bush (*Cephalanthus occidentalis*).

The primary substrate seemed to be mud/clay with fine sediment bottom deposit (Table 4.5 and 4.9). During the first survey aquatic vegetation was abundant, primarily in the form of duckweed as can be seen in Figure 4.6. During the second survey, aquatic vegetation was abscent (Figure

4.7) Algae cover was absent during both surveys. The water color was clear with some floating and submerged debris and odor remained rare during both surveys.

Figure 4.6 Photograph of White Oak Creek Site WH03 taken on July 19, 2016, the left bank view of the 150-m transect.

Wildlife observed included a water moccasin and evidence of wildlife included bird droppings. Minimal garbage was observed at this site. During the first survey, only small garbage in the channel was observed in the form of floating glass bottles. No garbage was observed during the second survey.

Figure 4.7 Photograph of White Oak Creek Site WH03 taken on August 25, 2016, the left bank view of the 150-m transect.

During the first survey when water levels enabled boating in the canopy of small trees, TIAER personnel observed some tree limbs that had been cut, seemingly to facilitate passage further upstream though the dense vegetation. During the second survey, TIAER personnel encountered the local game warden boating along the same stretch of creek between sites WH01 and WH03. Conversation with the individual confirmed the use of this stretch of creek for fishing. No recreational activities were observed at this site, although some fishing tackle was observed.

Physical Description of WH04 (Not surveyed)

Site WH04 was established at 6.09 miles from the confluence with the Sulphur River. Coordinates were calculated using geoprocessing software for a site at this location, however; this portion of the creek was not accessible during either survey. While access opportunities for this site are shared with sites WH01 – WH15, thick vegetation in the creek channel as well as in the upland areas of the White Oak WMA prohibited boat or foot access to this site. Wet conditions also prohibited the use of ATVs or 4WD vehicles through the White Oak WMA to sites. No surveys were conducted at this site.

Note for Sites WH05 – WH09

The access point for sites WH05 – WH09 was at the crossing with US Hwy 259 (Table 4.11). There was a paved parking lot and boat launch at this road crossing as well as a 4-wheel drive dirt path leading into the White Oak WMA on the east side of US Hwy 259. During both surveys, water levels required the use of a boat to access these sites.

Physical Description of WH05

White Oak Creek at site WH05 was visited on June 23 and August 25, 2016. This site was located 7.99 miles from the confluence with the Sulphur River and about 1.9 miles downstream from the US Hwy 259 crossing. Bank access was unattainable during the first survey as the banks were submerged and the canopy of the understory trees blocked any travel to the edge of the water. During the second survey, however, the banks were visible more frequently. Banks were slightly sloped and were extremely muddy and slick. Bank vegetation was thick in most places prohibiting access to the banks. Thalwegs during both surveys were greater than 1.5 m rendering the creek at this site non-wadeable (Table 4.6).

During the first survey, the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range at all 11 transects (Figure 4.8). Where a definitive width measurement was not possible, width measurements were recorded as the greatest visible distance of water between left and right banks. During the first survey the greatest width was estimated at 51 m, the narrowest was estimated at 30 m with an estimated typical width of 35 m (Tables 4.7 and 4.8). During the second survey the creek was back down within the main channel and both banks were visible (Figure 4.9). Widths ranged from 35 m to 18 m with a typical observed width of 30 m.

Figure 4.8 Photograph of White Oak Creek Site WH05 taken on June 23, 2016, the left bank view of the 0-m transect.

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Figure 4.9 Photograph of White Oak Creek Site WH05 taken on August 25, 2016, the left bank view of the 0-m transect.

Site WH05 was non-wadeable for the entire 300-m reach with depths greater than 1.5 m (Table 4.6). The dominant substrate of the stream at this site was mud/clay (Table 4.5). During the first survey duckweed was abundant but was not detected during the second survey (Tables 4.9 and 4.10). Algae cover was rare and odorless during both surveys. The color of the water was brown with surface debris during both surveys.

Small fish, turtles, and a snake were observed at this site and the call of a great blue heron was heard. During first survey and while traveling between WH06 and WH05, a river otter (*Lontra canadensis*) den was observed on the left bank (Figure 4.10). Although it was not located within the 300-m reach of Site WH05, given that river otters can range from 1.2 – 17 miles within a waterway, it is important to report their presence within this portion of the White Oak Creek corridor.

Figure 4.10 Photograph of White Oak Creek Site WH05 taken on June 23, 2016, a river otter lodge on the right bank.

Small garbage in the channel was rarely encountered during the first survey and consisted only of plastic and glass bottles. No garbage was seen during the second survey. Evidence of fishing was seen at this site in the form of drop lines secured to tree limbs that hung over the water. These lines were present during both surveys. No other evidence of recreation was observed at this site during surveys. However, during the scouting trip in May 2016, two fishermen were encountered who were baiting trotlines from a boat.

Physical Description of WH06

White Oak Creek at site WH06 was visited on June 23 and August 25, 2016. This site was located 8.59 miles from the confluence with the Sulphur River and 0.6 mile upstream from WH05. Bank access was unattainable during the first survey as they were submerged and the canopy of the understory trees blocked any travel to the edge of the water. During the first survey, the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range at 7 of the 11 transects (Figure 4.11). Where a definitive width measurement was not possible, width measurements were recorded as the greatest visible distance of water between left and right banks. During the first survey, the maximum width of the stream was estimated at 70 m, the narrowest was estimated at 20 m with an estimated typical width of 37 m (Table 4.7). During the second survey, the creek was back down within the main channel and both banks were visible for width measurements (Figure 4.12). Widths during this time ranged from 20 m to 12 m with a typical observed width of 17 m (Table 4.8).

Figure 4.11 Photograph of White Oak Creek Site WH06 taken on June 23, 2016, the right bank view of the 300-m transect.

Thalwegs during both surveys were greater than 1.5 m rendering the creek at this site non-wadeable (Table 4.6). The dominant substrate of the stream at this site was mud/clay (Table 4.5). Duckweed was common on the water surface during both surveys. No algae or odor were detected at this site and the bottom deposits were of fine sediment (Tables 4.9 and 4.10). The color of the water was brown and clear of scum or foam during both surveys, however floating debris was excessive during the second survey.

Figure 4.12 Photograph of White Oak Creek Site WH06 taken on August 25, 2016, the right bank view of the 300-m transect.

Wildlife encountered at this site during surveys included small fish and water birds, which included ducks. A bird nest was observed in the trees hanging over the channel. Garbage was not encountered during either survey and no evidence of recreation was observed at this site.

Physical Description of WH07

White Oak Creek at site WH07 was surveyed on June 23 and August 25, 2016. This site was located 9.86 miles from the confluence with the Sulphur River and 1.27 miles upstream from WH06. Bank access was unattainable during the first survey as the banks were submerged and the canopy of understory trees blocked any travel to the edge of the water. During the first survey, the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range at 7 of the 11 transects (Figure 4.13). Where a definitive width measurement was not possible, width measurements were recorded as the greatest visible distance of water between left and right banks. The maximum width of the stream was estimated at 30 m, the narrowest was estimated at about 15 m with an estimated typical width of 30 m (Table 4.7). During the second survey, the creek was back down within the main channel and both banks were visible for width measurements (Figure 4.14). Widths during this time ranged from 32 m to 19 m with a typical observed width of 22 m (Table 4.8).

Figure 4.13 Photograph of White Oak Creek Site WH07 taken on June 23, 2016, the left bank view of the 300-m transect.

Thalwegs during both surveys were greater than 1.5 m rendering the creek at this site non-wadeable (Table 4.6). The dominant substrate of the stream at this site was mud/clay (Table 4.5). Duckweed was common on the water surface during both surveys. No algae or odor was detected at this site and the bottom deposits were of fine sediment (Tables 4.9 and 4.10). The color of the water was brown and clear of scum or foam during both surveys.

Figure 4.14 Photograph of White Oak Creek Site WH07 taken on August 25, 2016, the left bank view of the 300-m transect.

Wildlife encountered at this site during surveys included small fish and water birds, which included ducks and a great blue heron. Evidence of wildlife included clam shells and crawfish burrows. Garbage was not encountered during either survey. Evidence of fishing was seen at this site in the form of drop lines secured to tree limbs that hung over the water. These lines were present during both surveys. No other evidence of recreation was observed at this site.

Physical Description of WH08

White Oak Creek at site WH08 was visited on June 23 and August 11, 2016. This site was located at the US Hwy 259 road crossing and 10.7 miles from the confluence with the Sulphur River. This site is inside the White Oak WMA where dense forest lines both banks. For the first 150 m of this site, bank access was moderately easy along the open right of way of the highway (Figures 4.15 and 4.16). Bank access for the other 150 m was unattainable during the first survey as the banks were submerged and the canopy of understory trees blocked any travel to the edge of the water. During the first survey, the creek was out of its banks and the edge of water extended into the flooded vegetation out of visible range at 1 of the 11 transects. Where a definitive width measurement was not possible, width measurements were recorded as the greatest visible distance of water between left and right banks. The maximum width of the stream was estimated at 44 m, the narrowest was estimated at about 28 m with an estimated typical width of 29 m (Table 4.7). During the second survey, the creek's water level was back down within the main channel, although still high. The majority of both banks were visible for width measurements (Figure 4.9). Widths during this time ranged from 33 m to 28 m with a typical observed width of 30 m (Table 4.8).

Figure 4.15 Photograph of White Oak Creek Site WH08 taken on Saturday, July 23, 2016 (a "peak recreation time"). Photo of the paved parking lot access point at US Hwy 259.

Figure 4.16 Photograph of White Oak Creek Site WH08 taken on June 23, 2016, the left bank view of the 150-m transect and access to creek from parking lot.

Thalwegs during the first survey were greater than 1.5 m rendering the creek at this site non-wadeable (Table 4.6). Wading was possible but challenging during the second survey. Average thalweg during the second survey was 1.1 m, however, a maximum depth of 1.4 m pushed the limits of wadeable due to varying heights of field personnel. The dominant substrate of the stream at this site was mud/clay (Table 4.5). Aquatic vegetation was rare, algae cover was absent, there was no odor detected and the bottom deposits were of fine sediment. (Tables 4.9 and 4.10). The color of the water was brown and clear of scum or foam during both surveys (Figures 4.17 and 4.18).

Figure 4.17 Photograph of White Oak Creek Site WH08 taken on June 23, 2016, the upstream view of the 300-m transect.

Figure 4.18 Photograph of White Oak Creek Site WH08 taken on August 11, 2016, the upstream view of the 300-m transect. TIAER personnel in photo.

Visual observations of wildlife and wildlife sign were made. Turtles, fish, an egret, crawfish, and swallows under the bridge were observed. Four snakes were encountered as well as raccoon tracks. No large garbage was detected in the channel. Bank garbage was rare and primarily restricted to the boat launch area. Garbage on the banks included scattered aluminum cans and cigarette butts at the boat launch area. Small garbage was seen in the channel including fishing bobbers and trotlines, aluminum cans, and a discarded t-shirt. There was no human presence at this site during surveys. However, during reconnaissance, two individuals were encountered fishing on the banks at the bridge. Also, when passing this site travelling to other sites, trucks with boat trailers were observed parked in the paved parking area and two individuals were observed loading a boat out of the creek.

Physical Description of WH09

White Oak Creek at site WH09 was surveyed June 23, 2016 and attempted on August 11, 2016. This site is located 11.98 miles from the confluence with the Sulphur River and 1.28 miles upstream from site WH08. This site exists within the WMA with a corridor dominated by dense native forest on both sides (Table 4.5). Access to this site was moderately difficult as it was only accessible by boating upstream from US Hwy 259 (Table 4.11). While this site was accessible for the first survey (Figures 4.19 and 4.20), access was attempted but unattainable during the second survey trip because lower water levels combined with logjams and fallen trees across the channel impeded travel by boat to the site. Additionally, dense bank vegetation and slick, steep muddy banks prohibited walking to the site (Figure 4.21). No second survey was conducted.

Site WH09 was non-wadeable during the first survey with an average thalweg of greater than 1.5 m (Table 4.6). The maximum width encountered was 33 m, the narrowest was 22 m with an estimated typical width of 25 m (Tables 4.7 and 4.8).

Figure 4.19 Photograph of White Oak Creek Site WH09 taken on June 23, 2016, the upstream view of the 150-m transect.

Figure 4.20 Photograph of White Oak Creek Site WH09 taken on June 23, 2016, the right bank view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10, respectively. The water was brown in color and the bottom deposit was a fine sediment. The water surface was mostly clear with some floating plant debris, aquatic vegetation and algae cover were absent. Turtles and fish were observed at the site. While not at the site, water dependent birds and snakes were encountered in the creek channel on the way to site WH09. Crawfish burrows and beaver tracks were seen in the mud on the banks. The only garbage encountered was a plastic bottle. Fishing trotlines were occasionally seen tied to the limbs of the understory trees that were inundated by the high water. No other evidence of human presence was encountered at this site.

Figure 4.21 Photograph of White Oak Creek taken on August 11, 2016, the upstream view at the logjam preventing access to WH09.

Special Note for Sites WH10 – WH12

Sites WH10 – WH15 were only accessible by boat launched from the Hill Hole bridge within the WMA at site WH14 (Table 4.11). Two logjams had a significant effect on accessibility of sites WH10 – WH12 during the 2016 sampling period. During the first survey, logjam-A (Figure 4.22) prevented TIAER personnel from reaching the original coordinates for WH11. Consequently WH10 was also inaccessible since it was downstream from WH11 and there was no access point that would allow access to WH10 from downstream. A new waypoint for WH11 was created at the logjam and an RUAA was conducted from that point since it was an adequate distance from WH12.

During the second survey, a fallen tree created logjam-B (Figure 4.23) which was encountered between WH12 and WH13 and upstream from logjam A. Logjam B existed during the first survey but higher water levels allowed TIAER personnel to exit the boat onto the tree trunk, drag the boat across the fallen tree, and continue downstream. Lower water levels during the second survey prevented dragging the boat over and were too high to allow the boat to pass under the tree trunk. Every effort was made to bypass the logjam on the both left and right banks and to pass the boat beneath the log. The left bank was accessible but dense vegetation restricted access further along the banks. Dense vegetation on the right bank restricted access to the banks from the stream. The boat motor would not fit under the fallen tree (Figure 4.24 and 4.25). As a result, this logjam prevented access to WH12, WH11, and WH10 during the second survey. The physical descriptions of the first surveys of WH11 and WH12 and associated photographs follow.

Figure 4.22 Photograph of White Oak Creek Site WH11 taken on June 23, 2016, of logjam-A and the downstream view of the 0-m transect.

Figure 4.23 Photograph of White Oak Creek between WH12 and WH13 taken on August 11, 2016, of logjam-B.

Figure 4.24 Photograph of White Oak Creek between WH12 and WH13 taken on August 11, 2016, of logjam-B. Note, motor housing will not fit beneath log. TIAER personnel in photo.

Figure 4.25 Photograph of White Oak Creek between WH12 and WH13 taken on August 11, 2016 of the left bank. Thick bank vegetation prohibiting further access downstream to WH12.

Physical Description of WH10

White Oak Creek at Site WH10 was attempted on June 23, 2016 and August 11, 2016, but this site was inaccessible due to a log jam within the creek.

Physical Description of WH11

White Oak Creek at site WH11 was accessed on June 23, 2016 and attempted on August 11, 2016. A second survey was not conducted due to the aforementioned reasons. This site is located 17.9 miles from the confluence with the Sulphur River and about 6 miles upstream from WH09, the nearest reachable downstream site. Stream channel and corridor characteristics were identical to WH09 (Table 4.5). Banks were steep and slippery. Accessibility was moderately difficult given the roughly 3-mile boat ride from the public boat ramp at Hill Hole and the need to drag the boat across a large logjam (Figures 4.23 and 4.24).

Site WH11 was non-wadeable with an average thalweg of greater than 1.5 m (Table 4.6). Widths were taken at each transect. The widest point measured 22 m, the narrowest was 17 m and the typical average width was about 21 m (Table 4.7).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10, respectively. The water at this site was brown in color with a bottom deposit of fine sediment (Figure 4.26). The surface was clear and no aquatic vegetation, algae, or odor was detected. A variety of wildlife was observed at this site including an owl in an overhanging tree and a water-dependent bird flying over the channel. A total of five

water snakes were seen throughout the 300-m stretch including one in a tree on the banks (Figure 4.27). Live and dead fish, and turtles were seen while surveying as well as a bird feather floating in the water. The only garbage encountered was a glass bottle and an empty ice chest. While no evidence of human recreation was observed at WH11, trotlines hanging from tree limbs were encountered during the boat ride to this site.

Figure 4.26 Photograph of White Oak Creek Site WH11 taken on June 23, 2016. Upstream view of 300-m transect.

Figure 4.27 Photograph of White Oak Creek Site WH11 taken on June 23, 2016. Left bank, diamondback water snake (*Nerodia rhombifer*) in tree hanging over the creek.

Physical Description of WH12

White Oak Creek at site WH12 was accessed on June 23, 2016 and attempted on August 11, 2016. A second survey was not conducted due to the aforementioned reasons. This site is located 19.43 miles from the confluence with the Sulphur River. Stream corridor was densely forested on both sides (Table 4.5 and Figure 4.28). Banks were steep and slippery. Accessibility was difficult given the roughly 1.6 mile boat ride from the public boat ramp at Hill Hole and the need to drag the boat across a large logjam (Figures 4.23 and 4.24). No other roads exist within the WMA to gain access to Site WH12.

Site WH12 was non-wadeable with all thalwegs exceeding 1.5 m. The channel widths ranged from 39 m to 23 m across with a typical width of about 34 m (Table 4.7 and 4.8).

Figure 4.28 Photograph of White Oak Creek Site WH12 taken on June 23, 2016. Upstream view of 0-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.1, respectively. The water was brown with a fine sediment bottom deposit. The surface of the water was clear with no aquatic vegetation, algae, or odor present. Various wildlife was seen including water dependent birds, turtles, fish, frogs, and a snake. Hog tracks were seen on the banks. No garbage was detected throughout the 300-m reach of this site, and there was no evidence of human recreation.

Physical Description of WH13

White Oak Creek at site WH13 was accessed on June 23, 2016 and August 11, 2016. This site is located 20.18 miles from the confluence with the Sulphur River. Stream corridor was densely forested on both sides much like WH12 (Table 4.5 and Figure 4.29). Banks were steep and slippery. Accessibility was difficult given the roughly 0.83 mile boat ride from the public boat ramp at Hill Hole (Table 4.6). No other roads exist within the White Oak WMA to gain access to Site WH13.

The site was non-wadeable during both surveys with average thalwegs greater than1.5 m (Table 4.6). Flow was high during both surveys but the water level was noticeably lower during the second survey (Figures 4.29 and 4.30). The channel and corridor appearance at this site was similar to the previous three sites. Widths during both the first and second survey ranged from 26 m at the widest point to 12 m at the narrowest with a typical average width of 14 m.

Figure 4.29 Photograph of White Oak Creek Site WH13 taken on June 23. 2016. Upstream view of 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10, respectively. During the first survey the water was brown with fine sediment and the surface was clear with no aquatic vegetation, algae or odor present. During the second survey all water characteristics were the same except occasionally scum and foam were observed on the water's surface. Various wildlife was seen including water dependent birds, fish, turtles, and two snakes. Other evidence of wildlife presence included raccoon tracks, hog tracks, hog wallow, and bird droppings on the banks. Evidence of wildlife seen while travelling to this reach, but not within it, included crawfish and mammal burrows in the stream banks. Garbage was absent from the banks and the channel. Trotlines were observed hanging from tree limbs but no other evidence of human recreation were encountered.

Figure 4.30 Photograph of White Oak Creek Site WH13 taken on August 11, 2016. Upstream view of 300-m transect. TIAER personnel in photo.

Physical Description of WH14

White Oak Creek at WH14 was accessed June 22 and August 11, 2016. This site is located 21.01 miles from the confluence with the Sulphur River at the Hill Hole bridge crossing and public parking lot within the WMA (Table 4.11). The accessibility of the site was moderately easy due to potential public access, however, steep, slippery banks made launching the boat challenging (Table 4.6). The dominant substrate was mud and clay with a native forest corridor (Table 4.5 and Figure 4.31).

Site WH14 was considered non-wadeable during both surveys. While some wadeable depths were measured during the second survey, there was one depth greater than 1.5 m rendering that stretch non-wadeable. Average thalwegs for the first and second surveys were greater than 1.5 m and 0.97 m respectively (Table 4.6). Typical widths during the first survey were about 16 m with a maximum width of 26 m and minimum of 16 m. Widths did not change from the first survey to the second (Tables 4.7 and 4.8). Although water flow was high during both surveys, water levels did drop between surveys (Figures 4.31 and 4.32). The creek was just within the channel during the first survey and had lowered down into the channel by the second survey. Banks were near vertical, therefore, a change in widths was not observed with the change in water level.

Figure 4.31 Photograph of White Oak Creek Site WH14 taken on June 22, 2016. Downstream view of 0-m transect. TIAER personnel in photo.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10, respectively. Aesthetics of the water did not change between surveys. The water was brown with a clear surface. The bottom deposits were fine sediment. No aquatic vegetation, algae, or odor were detected during either survey. Wildlife observed during the survey included ducks and four snakes. Other indications of the presence of wildlife included skunk tracks on the banks. Garbage was rare during the first survey and included plastic bottles in the stream, bricks and rebar on the banks at about the 120 m transect, cigarette butts, and .22 casings on the banks at the parking lot. During the second survey, large garbage consisted of an old shotgun case in the stream which was washed up on floating debris. Also a spent shotgun shell was found on the banks at the parking lot.

Figure 4.32 Photograph of White Oak Creek Site WH14 taken on August 11, 2016. Downstream view of 0-m transect.

Physical Description of WH15

White Oak Creek at site WH15 was surveyed June 22 and August 11, 2016. This site is located 21.8 miles from the confluence with the Sulphur River and approximately 0.8 mile upstream from site WH14. This site was publically accessible, by boat only, using the Hill Hole parking lot as an access point (Table 4.11). The accessibility of the site was moderately difficult because steep, slippery banks made launching the boat challenging in addition to having to boat upstream from the parking lot (Table 4.6). The dominant substrate was mud and clay and the flanking corridor was dense, native forest (Table 4.5 and Figure 4.33). Buttonbush was prevalent along the banks at this site and often would be hanging over the channel. Flood debris was also present in the canopies of bank vegetation.

Site WH15 was considered non-wadeable during both surveys. Although wadeable depths were recorded during the second survey, the turbidity of the water made it difficult to see below the surface and rendered copious amounts of submerged logs and tree debris undetectable. Steep, slick banks would prevent exiting the creek for the majority of the stretch. Based on these conditions, a boat was used and a non-wadeable designation was applied to the second survey.

Average thalwegs for the first and second surveys were greater than 1.5 m and 0.76 m respectively (Table 4.6). Typical widths during the first survey were about 14 m with a maximum width of 19 m and minimum of 11 m. Widths did not change from the first survey to the second (Tables 4.7 and 4.8).

Although water flow was high during both surveys, water levels did drop between surveys. The creek was just within the channel during the first survey and had lowered down into it by the

second. Banks were near vertical therefore a change in widths was not observed with the change in water level.

Figure 4.33 Photograph of White Oak Creek Site WH15 taken on June 22, 2016. Downstream view of 0-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10, respectively. During the first survey the water was brown with a clear surface. The bottom deposits were fine sediment and no aquatic vegetation, algae, or odor was detected during either survey. However, during the second survey, aquatic vegetation was more common and there was a rare occurrence of algae. Beginning at approximately the 60-m transect, foam, scum, and surface algae was detected. Also during the second survey, a log jam was encountered at the 270-m transect where the field crew were required to exit the boat and lift the boat over the log to continue the survey.

Figure 4.34 Photograph of White Oak Creek Site WH15 taken on August 11, 2016. Downstream view of 300-m transect.

Wildlife presence was detected included turtles, frogs, fish, and four snakes in the first survey. Hogs were also encountered on the left bank. During the second survey, a water snake and a water moccasin were seen in the creek. No garbage was detected during either survey. No evidence or occurrence of human recreation was observed at this site.

This concludes descriptions for sites occurring within the White Oak Creek Wildlife Management Area.

Physical Description of WH16

White Oak Creek at site WH16 was surveyed on June 22 and August 10, 2016. This site is located 34.04 miles from the confluence with the Sulphur River and approximately 12.25 miles upstream from WH15. Site WH16 was on private property and only accessible with landowner permission. Accessing this site was difficult and required driving a 4-wheel drive vehicle approximately two miles through private property pastures, passing through five gates (Table 4.6). Dense vegetation with no path prevented use of a vehicle from about the 150-m transect to the 300-m transect. Banks were extremely steep, slick, muddy, and approximately 3 m from the top of the slope to the water (Figures 4.35 and 4.36). Due to these conditions, depths and photographs were taken from the top of the right bank. Banks were native forest on the entire left bank while the right bank was half native forest and half pasture with some shrubs lining the pastured section of the reach (Table 4.5).

This site was non-wadeable during both surveys with average thalwegs greater than 1.5 m during the first survey and 1.2 m during the second survey (Table 4.6). Widths ranged from 25 m to 15 m

during the first survey and were typically about 19 m wide (Table 4.7). During the second survey, widths ranged from 20 m to 9 m with a typical width of about 10 m (Table 4.8). Observed flows remained high during both surveys.

Figure 4.35 Photograph of White Oak Creek Site WH16 taken on June 22, 2016. Upstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. Water conditions did not change from one survey to the other. The color was brown, the surface clear, and the bottom of the channel was fine sediment. No aquatic vegetation, algae, or odor were detected at this site. There was a downed tree at the 300-m transect hindering boat travel on the stream.

Evidence of wildlife at this site included tracks of raccoon and beaver. There were crawfish burrows in the banks, clam shells, feathers, and bird droppings. Small fish could be seen in the creek from the banks. The property owner's dog followed the survey crew down to the site during the first survey and cattle grazed the adjacent pasture. Trash was limited to bank garbage in the form of a chip bag, plastic bottle, and spent shot gun shells. A hunting blind and feeder were seen on the left bank at about the 30-m transect and approximately 50 m from the banks of the creek. There were ATV tracks observed along the banks for about half the surveyed length. No other evidence of human recreation were detected at this site.

Figure 4.36 Photograph of White Oak Creek Site WH16 taken on August 10, 2016. Upstream view of the 300-m transect.

Physical Description of WH17

White Oak Creek at site WH17 was surveyed June 22 and August 10, 2016. This site is located 35.38 miles from the confluence with the Sulphur River and about 1.3 mile upstream from WH16 on private property. Access to this site was difficult because it required permission from the landowner and use of a 4-wheel drive vehicle to travel through three gates and about two miles through rough pasture (Table 4.6). Accessibility would also more difficult after a rain because the pasture adjacent to the creek becomes muddy and impassable by vehicle. The banks of the creek at this site were steep, tall, and muddy, much like site WH16. Due to these conditions, most depths and photographs were taken from the top of the right bank. The corridor was natural forest on the left bank and half forest, half pasture on the right bank (Table 4.5 and Figures 4.37 and 4.38).

Figure 4.37 Photograph of White Oak Creek Site WH17 taken on June 22, 2016. Upstream view of the 300-m transect.

Site WH17 was non-wadeable during the first survey with all depths greater than 1.5 m. The average depth for the second survey was 0.7 m which is wadeable (Table 4.6). However, non-wadeable depths were encountered between transects during the second survey and the turbidity of the water prohibited the perception of the water's depth. Bank heights were around 3 m in most places and the slope of the banks were measured to be about 5° in most places (Figure 4.38). Widths of the stream varied from 15 m to 12 m during the first survey with a typical width of 13 m (Table 4.7). The second survey widths ranged from 16 m to 9 m with a typical width of 12 m (Table 4.8). Flow appeared high during the first survey but normal during the second.

Figure 4.38 Photograph of White Oak Creek Site WH17 taken on August 10, 2016. Downstream view of the 0-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. Water conditions did not change between survey events. The color was brown with a clear surface and fine sediment bottom. No aquatic vegetation, algae, or odor were detected. Most of the wildlife evidence was encountered during the first survey. Tracks of armadillo, turkey, possum, squirrel, beaver, and cattle were seen on the banks. Additionally, cow bones, a dead crawfish, crawfish burrows, hatched out turtle eggs, feathers, and bird droppings were observed. Frogs and a rat snake were encountered while walking the banks during the first survey as well (Figure 4.39). During the second survey, two snakeskins were found on the banks. No garbage was encountered during either survey. However spent shotgun shells were found on the way to the site within 100 m of the water as well as a hunting blind. No other evidence of human recreation were detected at this site.

Figure 4.39 Photograph of White Oak Creek Site WH17 taken on June 22, 2016. Rat snake (*Elaphe* sp.) on right bank.

Physical Description of WH18

White Oak Creek at site WH18 was surveyed July 20 and August 10, 2016. This site is located 37.51 miles from the confluence with the Sulphur River and about 2.13 miles upstream from site WH17. This site was difficult to access because it was on private property indicated by purple paint on a locked gate (Table 4.6). The pasture road leading to the creek was washed out and overgrown with understory vegetation which limited travel by foot or ATV. The site was about one mile from the private property gate at CR 3290 in Titus County. Similar to WH17, the banks of the creek at this site were steep, tall and muddy. Walking in the creek was difficult because submerged log debris, deep sucking mud, logjams, and fallen trees hindered or obstructed in-stream travel. The corridor was natural forest on both banks (Table 4.5 and Figures 4.40 and 4.41).

Figure 4.40 Photograph of White Oak Creek Site WH18 taken on July 20, 2016. Downstream view of the 150-m transect.

WH18 was wadeable during both surveys with average thalwegs of 0.7 m during both surveys respectively (Table 4.6). Observed flow and width measurements remained the same during both surveys. The widest point at this site was 14 m, the narrowest was 6 m, and the typical observed width was 9 m (Tables 4.7 and 4.8).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. Water characteristics were similar between surveys. The color of the water was brown and the surface was clear. The bottom deposits were of fine sediment with some sludge throughout the first survey. During the second survey the sludgy texture was gone and bottom deposits were only fine sediment. Aquatic vegetation and algae were absent during both surveys. However, an odor was detected occasionally during the first survey but not during the second.

Figure 4.41 Photograph of White Oak Creek Site WH18 taken on August 10, 2016. Downstream view of the 300-m transect. TIAER personnel in photo.

Various types of evidence of wildlife presence and activity were observed at WH18. Great blue herons, turtles, dead crawfish, and a snake were encountered in the stream corridor. Tracks of raccoon, hog, and canine were observed during the first survey. While conducting the second survey, two dogs followed the field crew from the county road one mile away down to the site and remained with the crew until the survey was completed (Figure 4.42). Other evidence of wildlife included crawfish burrows, bird droppings, bird feather, clamshells, and an unknown animal burrow in the banks.

Large and small garbage was rarely detected during the first survey and included an aluminum can and a tire. No garbage was encountered during the second. An old rotting pavilion was observed up on the banks at the 300-m transect. Also at this location, the banks had been cut as with a bulldozer. No other evidence of human recreation was detected at this site.

Figure 4.42 Photograph of White Oak Creek Site WH18 taken on August 10, 2016. Two dogs in the stream. TIAER personnel in photo.

Physical Description of WH19

White Oak Creek at site WH19 was surveyed on July 19 and August 10, 2016. This site is located 38.23 miles from the confluence with the Sulphur River and about 0.72 mile from site WH18. This site was publically accessible at FM 1402 (Table 4.11). Accessing this site was easy because a worn path on the west side of FM 1402, which allowed TIAER personnel to back the truck with trailer and boat down to the edge of the creek. The corridor at WH19 was forested on both banks. Banks were steep throughout the stretch and the dominant substrate was fine sand (Table 4.5). Walking in the creek was difficult because turbid water obscured submerged log debris, mud, and deep depths. Logjams and fallen trees hindered or obstructed in-stream travel (Figures 4.43 and 4.44). Additionally, flood debris lodged in the canopy above the water was observed at this site.

Site WH19 was considered wadeable and non-wadeable as varied depths were encountered. The 150-m transect was associated with the point of entry for the surveys. The depth here during the first survey was greater than 1.5 m, which is non-wadeable for the majority of personnel. Therefore, a boat was used to survey this site. Average thalweg depth was 1.1 m for the first survey and 1.0 m for the second survey (Table 4.6). Observed flow was normal during both surveys. Widths ranged little between surveys. During the first survey, maximum width was 15 m, minimum was 5 m, and the typical width was 12 m (Table 4.7). During the second survey, the water had receded. The maximum remained 15 m and the minimum width was still 5 m, but the typical width observed was 11 m (Table 4.8).

Figure 4.43 Photograph of White Oak Creek Site WH19 taken on July 19, 2016. Upstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. During the first survey the water was brown and the surface clear of any floating debris and the bottom deposits were fine sediment. The second survey found the water surface developed some occasional scum and floating debris in some areas but clear in others. Algae was absent during both surveys. Aquatic plants in the form of duckweed and an odor were noticed occasionally during only the second survey.

Figure 4.44 Photograph of White Oak Creek Site WH19 taken on August 10, 2016. Downstream view of the 300-m transect.

Evidence of wildlife was observed during both surveys and included tracks of armadillo, deer, and hogs. Hog wallows, crayfish burrows, small fish, and a water snake were also observed. A water moccasin was encountered during the second survey (Figure 4.45).

Not during the surveying period but during the reconnaissance visit (May 2016) to this road crossing, field personnel traveled by boat a greater distance downstream than was incorporated into the site's most downstream transect. It is notable that, at an unknown distance downstream from CR 1402, a rookery was encountered in the trees lining the creek. Both great egrets and great blue heron were observed occupying nests as well as carrying nest material as they flew. As many as 11 nests were counted in one tree with numerous trees supporting nests. Anhinga were also observed perched and flying above the canopy.

Garbage was rare during both surveys. Small garbage included glass bottles, Styrofoam, and plastic bottles. Larger garbage included a remnant of a steel 55 gallon drum and an old tire. At the 30-m transect, an old fishing boat, appearing to have been submerged in floodwaters, was encountered resting on the right bank. Drop lines for fishing were seen hanging from an occasional branch. No other evidence of human recreation was detected at this site.

Figure 4.45 Photograph of White Oak Creek Site WH19 taken on August 10, 2016. Water moccasin (*Agkistrodon piscivorous*).

Physical Description of WH20

White Oak Creek at site WH20 was surveyed June 19 and August 10, 2016. This site was located 46.35 miles from the confluence with the Sulphur River and about 8 miles from WH19 and publically accessible where the CR 1905 bridge crosses the creek. On the southeast side of this bridge was a steep dirt path leading down to the creek bank from the paved county road. The banks at this location were gradually sloping. However, the mud at the edge of the water was shin deep and slick, which made launching and loading the boat difficult (Table 4.6). The corridor at WH20 was native forest on both banks, which were densely vegetated up to the edge of the water (Table 4.5). A boat was used at this site because the turbidity of the water obscured submerged log debris, mud, and inhibited knowledge of depths (Figure 4.46). Logjams and fallen trees were scattered along this stretch of creek, and the debris significantly congested or obstructed in-stream travel (Figure 4.47).

This site was wadeable during both surveys with average thalwegs of 0.2 m during both surveys (Table 4.6). Observed flow was normal during both surveys and depths did not vary significantly enough to change width measurements between surveys. Widths ranged from 4 m to 2 m with a typical observed width of 3 m.

Figure 4.46 Photograph of White Oak Creek Site WH20 taken on July 19, 2016. Downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. The water surface during the first survey was brown with some scum in places. Common to both surveys was the absence of aquatic vegetation and odor as well as the presence of algae. The bottom deposits were fine sediment during both surveys as well. Submerged and floating logs were encountered which made boating through the channel difficult. During the second survey, foam was encountered at the 30-m transect.

Figure 4.47 Photograph of White Oak Creek Site WH20 taken on August 10, 2016. Downstream view of the 300-m transect.

Evidence of wildlife included tracks of raccoon and hogs in addition to a hog wallow. Bird droppings and feathers were seen on the stream banks. Crawfish burrows and clamshells were also observed at this site. Various garbage was found at this site. Aluminum cans, glass bottles, tires, a discarded welding torch, and a metal bucket. Occasional drop lines for fishing were observed, but no other evidence of human recreation was observed at this site.

Physical Description of WH21

White Oak Creek at site WH21 was surveyed June 19 and August 10, 2016. This site was located 46.68 miles from the confluence with the Sulphur River and about 0.33 mile from WH20, and publically accessible where the County Road 1905 bridge crosses the creek. On the southeast side of the bridge was a steep dirt path leading down to the creek bank from the paved county road that was used to access the creek. The banks at this location were gradually sloping. However, the mud at the edge of the water was shin deep and slick, which made launching and loading the boat difficult (Table 4.6). The corridor at WH21 was native forest on both banks, which were densely vegetated up to the edge of the water (Table 4.5). A boat was used at this site, because the turbidity of the water obscured submerged log debris, mud, and inhibited knowledge of depths (Figures 4.48 and 4.49). Fallen trees were scattered along this stretch of creek and some significantly congested in-stream travel.

This site was wadeable during both surveys with average thalwegs of 1.2 m during the first survey and 1.0 m during the second survey (Table 4.6). Observed flow was normal during both surveys but width measurements varied between surveys. Widths ranged from 23 m to 7 m with a typical

observed width of 14 m during the first survey (Table 4.7). Second survey widths ranged from 23 m to 10 m with a typical observed width of 19 m (Table 4.8).

Figure 4.48 Photograph of White Oak Creek Site WH21 taken on July 19, 2016. Downstream view of the 0-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. The water surface during both surveys was brown with some scum and foam in places. Common to both surveys was the absence of aquatic vegetation or odor and the rare presence of algae. The bottom deposits were fine sediment during both surveys as well. Submerged and floating logs were encountered, which made boating through the channel difficult.

Figure 4.49 Photograph of White Oak Creek Site WH21 taken on August 10, 2016. Upstream view of the 300-m transect.

Evidence of wildlife was present during both surveys. Large and small fish, turtles, and a snake were encountered. Cliff swallows and their nests were encountered at the CR 1905 bridge, which also happened to be the 300-m transect. Crawfish burrows were observed on the banks as well as a feather in the water. Large and small garbage were rarely seen during both surveys and included plastic bottles, aluminum cans, and a large piece of culvert. A cane pole was found lodged in some tree limbs that reached out over the water from the banks. No other evidence of recreation was encountered at this site.

Physical Description of WH22

White Oak Creek at site WH22 was surveyed July 19 and August 10, 2016. This site was located 47.12 miles from the confluence with the Sulphur River and about 0.44 mile from WH21 and publically accessible where the CR 1905 bridge crosses the creek. On the southeast side of this bridge was a steep dirt path leading down to the creek bank from the paved county road, which was used to access the creek. The banks at this location were gradually sloping. However, the mud at the edge of the water was shin deep and slick, which made launching and loading the boat difficult (Table 4.6). The corridor at site WH22 was largely native forest on both banks, which were densely vegetated up to the edge of the water (Table 4.5). A section of pasture did exist for a stretch along the right bank from about the 300-m transect up to about the 150-m transect. A boat was used at this site, because the turbidity of the water obscured submerged log debris, mud, and inhibited knowledge of depths (Figure 4.50). Logjams and fallen trees were scattered along this stretch of creek and some significantly congested or obstructed in-stream travel (Figure 4.51).

Figure 4.50 Photograph of White Oak Creek Site WH22 taken on August 10, 2016. Downstream view of the 300-m transect.

This site was wadeable during both surveys with average thalwegs ranging from 1.08 m during the first survey and 1.33 m during the second (Table 4.6). Observed flow was normal during both surveys. The first survey widths ranged from 21 m to 10 m with a typical observed width of 12 m (Table 4.7). While during the second survey, widths ranged from 30 m to 9 m with a typical observed width of 18 m (Table 4.8).

Figure 4.51 Photograph of White Oak Creek Site WH22 taken on July 19, 2016. Upstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. The water surface was brown during both surveys. Debris was common on the water surface during the first survey then cleared up by the second survey. Common to both surveys was the absence of aquatic vegetation and odor. Algae was rarely encountered during the first survey and it was not detected during the second. The bottom deposits were fine sediment during both surveys as well. Submerged and floating logs were encountered, which made boating through the channel difficult.

Wildlife encountered at this site included small fish and turtles. Evidence of wildlife included deer, hog, and raccoon tracks as well as crawfish burrows. Bird droppings were also encountered on the banks. Garbage was limited at this site. No trash was noticed during the first survey however a bucket was seen in the channel during the second survey. A trotline for fishing was also encountered at this site. No other evidence of recreation was encountered at this site.

Physical Description of WH23

White Oak Creek at site WH23 was attempted on July 20 and August 9, 2016. This site was located about 53.45 miles from the confluence with the Sulphur River and 6.32 miles from site WH22. Access to this site was difficult. A boat was put in at the bridge at US Hwy 271 to access this point about 1.3 miles downstream. The banks at the bridge were near vertical, muddy, and vegetated with tall weeds. The boat was deployed by attaching it with a rope to the hitch of the field truck and lowering it down to the water. Retrieving the boat required the same method.

Traveling to Site WH23 in the boat was possible; however, a large logjam (Figure 4.52) was encountered on both survey dates that blocked access to the entire stretch of transects. Depths up to this logjam were greater than 1.5 m, thus, non-wadeable. The water was brown and turbid and the surface was covered with scum, debris, and duckweed. The right bank was steep and densely vegetated (Figure 4.53). Similarly, the left bank was overgrown and muddy. These bank conditions prohibited bank access and therefore circumventing the logjam.

Figure 4.52 Photograph of White Oak Creek taken on July 20, 2016 during the first attempt to access Site WH23. Downstream view at logjam preventing access to WH23.

Figure 4.53 Photograph of White Oak Creek taken on August 9, 2016 during the second attempt to access Site WH23. Right bank view at the logjam preventing access to WH23.

Physical Description of WH24

White Oak Creek at site WH24 was surveyed on July 20 and August 9, 2016. This site was located about 54.71 miles from the confluence with the Sulphur River and about 1.27 miles from Site WH23. Access was public but difficult at the US Hwy 271 bridge (Table 4.6). There was a paved path that led down to the northeast side of the bridge from the side of the highway. Banks here were near vertical, muddy, and vegetated with tall weeds with rip-rap immediately below the bridge. Non-wadeable depths indicated the need to survey by boat. A boat was deployed by lowering it down to the water by a rope attached to the field truck hitch. Retrieving the boat required the same method and pulling it ashore with the field truck. The corridor at WH24 was forest on both banks and the primary substrate was mud and clay (Table 4.5).

This site was non-wadeable with average thalwegs greater than 1.5 m during the first survey and 1.5 m during the second (Table 4.6). Observed flow was normal during both surveys. Widths varied slightly from one survey to the other. The greatest width measured in the first survey was 38 m, the narrowest was 12 m with a typical observed width of 30 m (Table 4.7). During the second survey, the widest width observed was 39 m, the narrowest 17 m, and the typical observed width was about 23 m (Table 4.8).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4.9 and 4.10. Brown colored water, excessive amounts of duckweed, foam, scum, and other floating debris were characteristic of the water surface during both surveys (Figures 4.54 and 4.55). Aquatic vegetation was common and algae was rare during both surveys. No odor was ever detected (Table 4.9 and 4.10).

Figure 4.54 Photograph of White Oak Creek Site WH24 taken on July 20, 2016. Upstream view of the 0-m transect.

Wildlife presence and signs were elusive during the second survey, however large and small fish were observed during the first survey. Additionally, bird feathers and a set of unknown tracks (narrowed down to otter or beaver) were observed. Garbage was rarely seen only during the first survey and included aluminum cans and plastic bottles. No evidence of human recreation was observed at this site.

Figure 4.55 Photograph of White Oak Creek Site WH24 taken on August 9, 2016. Downstream view of the 150-m transect.

Physical Description of WH25

White Oak Creek Site WH25 was visited on July 20 and August 9, 2017 and was approximately three quarters of a mile upstream of US Hwy 271 in Titus County. This site can only be publically accessed via boat downstream at the bridge crossing at US Hwy 271 (where White Oak Creek Site WH24 is located). TIAER personnel accessed this site by launching a boat at the public bridge crossing on US Hwy 271 and traveled downstream. Private property fencing prohibited TIAER personnel to access the riparian area at WH25.

This site is located in a forest dominated corridor (Table 4.5). Access to the stream was difficult due to lack of public accessibility, steep slippery banks, and dense vegetation. Logjams and tree debris littered the stream at this location. Even then, navigating the stream in a boat was the easiest way to reach this portion of White Oak Creek. Figures 4.56 and 4.57 depict the appearance of the site during each of the surveys.

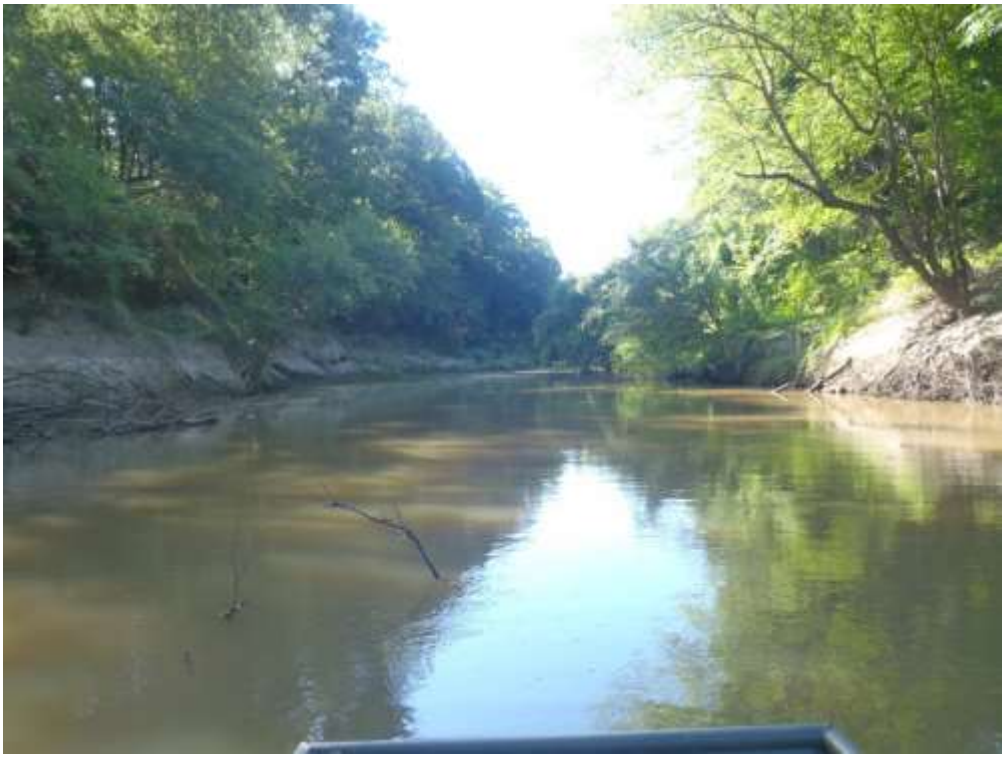

Figure 4.56 Photograph of White Oak Creek Site WH25 taken on July 20, 2016. Downstream view of the 0-m transect.

While Site WH25 could be considered wadeable by some, water depths exceeded wadeable conditions for present TIAER personnel. Average thalweg depths were 1.4 m during the first survey and 1.3 m during the second survey (Table 4.6). Stream widths ranged from a minimum of 13 m to a maximum of 25 m during the first survey (Table 4.7). Stream widths ranged from 12 m to 25 m during the second survey (Table 4.8). TIAER personnel measured a typical width of 14 m during the first survey and 20 m during the second survey. Stream flow type was characterized as intermittent during both surveys. Similar to the other RUAA sites on White Oak Creek, the dominant substrate at this site was fine sediment.

Figure 4.57 Photograph of White Oak Creek Site WH25 taken on August 9, 2016. Upstream view of the 150-m transect. TIAER personnel in photo.

While the water surface was clear during the first survey, it contained foam and scum during the second survey (Tables 4.9 and 4.10). No water dependent birds, reptiles, or mammals were observed during either survey. No wildlife tracks or feces were observed during either survey due to an inability to see most of the stream bank. Aquatic vegetation and algae cover were absent during both surveys as was large and small garbage in the stream channel and along the stream banks. No evidence of human presence was observed throughout the reach during either survey.

Physical Description of WH26

White Oak Creek at Site WH26 was visited on July 20 and August 9, 2016. This site was located on White Oak Creek north northwest of Mount Vernon in Franklin County on CR 2100. Site WH26 was publically accessible at the crossing but was fenced on the left and right riparian areas of the stream. The large, stream corridor consisted of primarily native forest on both the right and left banks (Table 4.5). Access to the stream was difficult due to the steep, slippery banks, and large amounts of garbage directly up and downstream of the road crossing (Figures 4.58 and 4.59). The 150-m transect was the only one with large garbage. It was noted by TIAER personnel that steps were carved out of the bank directly at the bridge. It appeared the steps were created with a shovel or similar tool. The general appearance of the remaining transects is depicted in Figure 4.60.

Figure 4.58 Photograph of White Oak Creek Site WH26 taken on July 20, 2016. Upstream view of the 150-m transect.

Site WH26 was wadeable for most of the 300-m reach with an average thalweg depth of 0.8 m during the first survey and 0.7 m during the second survey (Table 4.6). The stream flow type at this site was intermittent during both surveys. The maximum width of the stream remained constant between both surveys at 10 m (Table 4.7). However, the minimum width and average varied greatly between the two surveys. The minimum width of the stream at this site was 1.5 m with a typical average of 3.5 m during the first survey and a minimum of 5 m during the second survey with a typical average width of 6 m. The dominant substrate of the stream at this site was fine sediment and sludge and had an odor of old mud during the first survey (Tables 4.9 and 4.10). This site contained multiple fallen trees throughout the 300-m reach creating obstacles within the stream channel. A large tree had fallen across the channel sometime between the first and second survey at the 300-m transect.

Figure 4.59 Photograph of White Oak Creek Site WH26 taken on August 9, 2016. Downstream view of the 150-m transect and excessive garbage. TIAER personnel in photo.

As previously mentioned, this site contained an abundant amount of garbage (large and small) in the stream channel at the 150-m transect. This could be contributed to this transect being at a road crossing and local residents using this site's bridge as a dump. Large items in the stream channel included a mattress, child's bicycle, rolled carpet, a glass door, a plastic tarp, an oscillating fan, an artificial Christmas tree, several tires, large steel pieces, and a water hose. Typical garbage, such as glass bottles and aluminum cans, were present as well.

Figure 4.60 Photograph of White Oak Creek Site WH26 taken on August 9, 2016. Downstream view of the 0-m transect.

TIAER personnel encountered two hogs near the 30-m transect during the first survey. Hog wallows and tracks, raccoon tracks, and signs of beaver gnawed wood were common throughout the 300-m reach during both surveys. There was a slight presence of crawfish, clam shells, snakes, and small fish during the first survey, but not during the second. The water surface was foamy during the first survey, but clear during the second. No evidence of human recreation was observed at this site.

Physical Description of WH27

No RUAA survey was conducted at Site WH27.

White Oak Creek at Site WH27 was visited on July 20 and August 9, 2016. This site was located on White Oak Creek approximately half a mile downstream of SH 37 in Franklin County. During the initial reconnaissance trip, TIAER personnel were able to launch a small boat at the intersection of White Oak Creek and SH 37 and navigate to WH27. However, fallen water levels exposed a large logjam (Figure 4.61), which prevented TIAER personnel from navigating via boat to Site WH27. Non-wadeable depths encountered while traversing to the site prohibited access to the site via the stream channel. Near vertical left and right banks with thick vegetation prohibited TIAER personnel from walking alongside White Oak Creek to reach site WH27.

Figure 4.61 Photograph of White Oak Creek taken on July 20, 2016. Logjam preventing access to WH27.

TIAER personnel assessed the conditions a second time on August 9, 2016. Unfortunately, the conditions traveling to this site were the same as when visited on July 20, 2016.

Physical Description of WH28

White Oak Creek site WH28 was visited on July 20 and August 9, 2016. This site was located at the crossing of White Oak Creek at SH 37 in Franklin County and only publically accessible at the right-of-way associated with the bridge and road. While the State Highway has sufficient shoulder space for parking, it has a high volume of traffic moving at fast speeds. Access was difficult because the right-of-way was overgrown and a private property fence was on the east side of the highway.

The creek at this site passes through native, forest vegetation. The riparian area was large with trees and native forest leading directly up to the edge of the stream bank (Table 4.5). The dominant substrate at this site was primarily sand, silt, mud, and clay causing TIAER personnel to sink to their knees and making walking on the banks and through the channel very challenging. Figure 4.62 illustrates the general appearance of White Oak Creek at this site.

While some depths allowed for wading, non-wadeable depths were encountered during the first survey and near non-wadeable depths encountered during the second survey. To obtain measurements, photos, and observations, TIAER personnel were able to climb through the vegetation on the banks to complete the entire survey reach. Average thalweg ranged from 0.8 m to 0.7 m between surveys, and stream flow type was characterized as intermittent (Table 4.6). Minimum channel widths were 2 m during the first survey and 1.5 m during the second survey.

Maximum channel widths and a typical average width remained constant between the two surveys at 12 m and 10 m, respectively (Tables 4.7 and 4.8).

Figure 4.62 Photograph of White Oak Creek Site WH28 taken on July 20, 2016. Upstream view of the 300-m transect.

Aquatic vegetation was absent during both surveys, but small fish were observed during the first survey. Algae cover was rare and a strong odor was common at this site during both surveys (Tables 4.9 and 4.10). Foam, scum, and bubbles on the water surface were observed throughout the 300-m reach during both surveys. Figure 4.63 depicts logjams and tree debris that was common throughout the 300-m reach.

Wildlife presence at this site on White Oak Creek included hog wallows and tracks as well as deer and raccoon tracks during both surveys. Additionally, bird fecal droppings were spotted on tree trunks and banks throughout the surveys.

Small garbage in the channel and on the banks included an empty vehicle motor oil container and glass jars. Three sticks used as fishing anchors were observed along the bank during the first survey. This was the only evidence of human presence observed throughout the 300-m reach during both surveys.

Figure 4.63 Photograph of White Oak Creek Site WH28 taken on August 9, 2016. Downstream view of the 0-m transect.

Physical Description of WH29

Site WH29 on White Oak Creek was not accessible for an RUAA survey. This site was located on private property of CR NW 1040, behind a locked gate, approximately 1.75 miles through pasture and forest. This site was only accessible via ATV due to , rough pasture and lack of maintained vehicle roads. The TIAER field vehicle remained parked at the entrance to the property off the county road. The ATV was then unloaded and driven to the site. During the initial reconnaissance visit to this site, the path to the creek had been shredded, which allowed decent visibility of the trail. Upon the first survey trip however, tall vegetation had grown obscuring the trail, large limbs had blown down across the path, and recent rains had washed some of the road away (Figure 4.64). Due to the drastic change in the vegetation growth and road conditions since the initial reconnaissance trip, it took TIAER personnel over 30 minutes to find White Oak Creek at this location.

During transport to the site, the ATV's left front wheel dropped into a washed out culvert that was obscured by the tall vegetation. Additionally, multiple trees had fallen across paths previously taken, making traveling to this site very difficult. Some trees were able to be winched out of the way using the ATV; however, one tree was too large and heavy to be moved by the ATV (Figure 4.65). Once TIAER personnel were able to locate WH29, bamboo had grown too thick to pass through to access the bank (Figure 4.66). This site was not surveyed due to inaccessibility.

There were no signs of recreation observed in the area surrounding this site.

Figure 4.64 Photograph of White Oak Creek taken on July 22, 2016. Tall vegetation in corridor of Site WH29. TIAER personnel in photo.

Figure 4.65 Photograph of White Oak Creek Site WH29 taken on August 29, 2016. Upstream view from access point.

Figure 4.66 Photograph of White Oak Creek Site WH29 taken on August 29, 2016. Thick vegetation at access point.

Physical Description of WH30

White Oak Creek site WH30 was visited on July 22 and August 8, 2016. This site was located at the intersection of FM 900 and White Oak Creek in Hopkins County. Site WH30 was only accessible at the bridge crossing on FM 900 due to private property beyond the bridge. Parking was available on the right-of-way of FM 900, so TIAER personnel were able to walk the streambed to conduct the survey of the 300-m reach.

The area had a mowed and maintained corridor making access to the creek easy despite the steep banks. However, beyond the bridge crossing, this site had thick, native forest vegetation reaching directly to the edge of the stream bank (Figures 4.67 and 4.68). The riparian area at this site was large throughout the full 300-m reach (Table 4.5).

Figure 4.67 Photograph of White Oak Creek Site WH30 taken on July 22, 2016. Upstream view of the 0-m transect.

Site WH30 was barely wadeable during both surveys. The average thalweg was 0.9 m with a maximum thalweg of 1.3 m during the first survey. The average thalweg during the second survey was 0.9 m with a maximum thalweg of 1.4 m (Table 4.6). While the stream flow was characterized as intermittent during the first survey, it was designated as intermittent with perennial pools during the second survey. This could be attributed to the r 0.51 inches reported for Sulphur Springs between the two surveys (Table 4.3). The typical widths of the stream remained constant at 16 m during both surveys (Tables 4.7 and 4.8).

One fish was observed during the first survey and a water snake was observed during both surveys. Wildlife tracks were identified as raccoon and beaver or otter, while feces were identified as bird. Other presence of wildlife consisted of hog wallows, crawfish and crawfish burrows, turtles, and birds spread throughout the 300-m reach. A dead hog floating in the creek under the FM 900 bridge was believed to be the source of a strong, stagnant odor during the first survey (Table 4.9). The hog and odor were absent when TIAER personnel returned to complete the second survey (Table 4.10).

Figure 4.68 Photograph of White Oak Creek Site WH30 taken on August 8, 2016. Right bank view of the 0-m transect.

Aquatic vegetation was absent during both surveys, while algae cover was rare during the first survey. There was little trash observed within the stream channel, and trash was also rare along the bank. The trash noted was found at the bridge crossing and consisted of concrete and rebar submerged under the bridge and an aluminum can on the stream bank under the bridge. Additional evidence of human presence observed was a fish trap on the bank that was spotted along the 300-m reach during the second survey.

Physical Description of WH31

White Oak Creek at site WH31 was visited on July 22 and August 9, 2016. This site was accessed through a private property gate off CR 3524. Access was granted by the landowner to enter the property leading to the creek. TIAER personnel entered the property via a truck, but because of extremely dense vegetation and trees, an ATV was used to travel the approximate 1.5 miles to the access point. The large riparian area was densely forested on both the left and right banks and continued up to the stream bank (Table 4.5). Banks at this site were incredibly steep and slippery making stream access difficult. TIAER personnel had to use tree vines and roots as a ladder to climb out of the stream banks once the surveys were completed. Figures 4.69 and 4.70 depict the appearance of the site during each of the surveys.

Figure 4.69 Photograph of White Oak Creek Site WH31 taken on July 22, 2016. Upstream view of the 300-m transect.

Due to the abundance of water moccasins encountered during the second survey, TIAER personnel did not complete the full 300-m reach. A total of seven water moccasins were encountered during the 120-m reach that TIAER personnel completed. Five water moccasins were seen between the 0-m and 90-m transects and two hatchlings were seen on the stream bank at the 120-m transect. Due to safety concerns associated with the abundance of venomous snakes, TIAER personnel completed the RUAA survey at the 120-m transect. An additional water moccasin was encountered in the riparian area as TIAER personnel were leaving this site.

Figure 4.70 Photograph of White Oak Creek Site WH31 taken on August 9, 2016. Upstream view of the 0-m transect. TIAER personnel in photo.

Site WH31 was wadeable with an average thalweg of 0.4 m during both surveys (Table 4.6). Stream widths ranged from a minimum of 4 m to a maximum of 10 m during the first survey to a minimum of 3 m and a maximum of 9 m during the second survey. A typical average of the stream width at this site was 9 m during the first survey and 8 m during the second survey (Tables 4.7 and 4.8).

Aquatic vegetation and algae cover were absent during both surveys. The bottom deposit at this site was fine sediment, coined "sinking mud" by TIAER personnel. The fine sediment had a

unique odor when disrupted by walking. The channel had many large log jams and was littered with tree debris both submerged and on top of the water that made navigating the channel difficult.

There was a slight presence of reptiles that included one water moccasin, two nonvenomous water snakes, small fish, crawfish, and frogs during the first survey. Also noted during the first survey was a 5-gallon bucket. No other garbage was seen in the stream channel or along the banks during either survey. Hog wallows and tracks were present along with raccoon and otter tracks during both surveys (Tables 4.9 and 4.10). No evidence of human presence was observed throughout the reach during either survey.

Physical Description of WH32

White Oak Creek at Site WH32 was visited on July 21 and August 7, 2016. This site was accessed via a locked private property gate, approximately 1 mile from the public road. Access was granted by the landowner to enter the property leading to White Oak Creek Sites WH32, WH33, and WH34. The large riparian area was densely forested on both the left and right banks and continued up to the stream bank (Table 4.5). Banks at this site were incredibly steep, slippery, and poison ivy was abundant. These factors made stream access difficult. Additionally, this site contained a large amount of tree debris and large logjams (Figures 4.71 and 4.72) during both surveys making walking through the channel difficult.

Figure 4.71 Photograph of White Oak Creek Site WH32 taken on July 21, 2016. Upstream view of the 300-m transect.

With a stream flow designated as intermittent during both surveys, Site WH32 was wadeable with an average thalweg of 0.7 m during during both surveys (Table 4.6). Stream widths ranged from a minimum of 7 m to a maximum of 12 m with a typical average of 10 m during both surveys (Tables 4.7 and 4.8). There was a slight presence of reptiles at this site during both surveys with

small fish, two nonvenomous snakes, and two water moccasins present in the stream channel during the first survey and two nonvenomous water snakes present during the second. Wildlife included raccoon, otter, deer, and hog tracks during both surveys. While no water dependent birds were spotted during either survey, bird droppings were present on trees and banks during both surveys (Tables 4.9 and 4.10).

Figure 4.72 Photograph of White Oak Creek Site WH32 taken on August 9, 2016. Upstream view of the 150-m transect.

Foam, scum, and duckweed were noted by TIAER personnel as being present on the water surface during the second survey. Aquatic vegetation was absent during the first survey but present during the second. Also present during both surveys were algae cover as well as a stale odor. The only garbage present in the stream channel was a tire during the first survey. No evidence of human presence was observed throughout the 300-m reach during either survey.

Physical Description of WH33

White Oak Creek at Site WH33 was visited on July 21 and August 7, 2016. This site was located on private property, 1 mile behind a locked gate. TIAER personnel accessed this site with landowner permission via a Polaris Ranger. The large riparian area was densely forested on both the left and right banks and continued up to the stream left bank of the stream. Pastureland extended beyond the native forest vegetation on the right bank (Table 4.5). In addition to containing dense bank vegetation, banks at this site were incredibly steep and slippery making stream access difficult. Logjams and low hanging trees made navigating through the channel difficult at this site (Figures 4.73 and 4.74). Due to the dense vegetation on the steep and slippery banks and a large logjam in the stream channel, TIAER personnel was unable to access the 300-m

transect during the second survey. Photographic evidence of stream channel and banks were collected at the 270-m transect.

Figure 4.73 Photograph of White Oak Creek Site WH33 taken on July 21, 2016. Downstream view of the 300-m transect. TIAER personnel in photo.

The stream flow at this site was designated as intermittent during both surveys. Site WH33 was wadeable with an average thalweg of 0.7 m during the first survey and 0.5 m during the second survey (Table 4.6). Stream widths ranged from a minimum of 3 m to a maximum of 10 m with a typical average of 9 m during both surveys (Tables 4.7 and 4.8).

There was a slight presence of reptiles at this site with water moccasin and frogs present in the stream channel during both surveys. Hogs were spotted by TIAER personnel between the 30-m and 60-m transects during the second survey. This coincides with the hog wallows and tracks seen throughout the reach during both surveys. Other wildlife observed included raccoon and otter tracks as well as tree limbs gnawed by beavers and otter slides on the stream banks during the first survey. Cow tracks and feces were observed on the stream banks during the second survey only. While no water dependent birds were spotted during either survey, a bird nest in a low hanging tree along with bird droppings on trees and banks were observed during the first survey (Tables 4.9 and 4.10).

Figure 4.74 Photograph of White Oak Creek Site WH33 taken on August 9, 2016. Upstream view of the 0-m transect.

Aquatic vegetation was absent during both surveys while algae cover was only present in the second survey (Tables 4.9 and 4.10). TIAER personnel detected an occasional odor at this site during the first survey that became common throughout the full reach during the second survey. The only garbage present was plastic bottles in the stream channel during the first survey. No evidence of human presence was at this site during either survey.

Physical Description of WH34

White Oak Creek at site WH34 was visited on July 21 and August 7, 2016. This site was located on private property behind a locked gate. TIAER personnel accessed this site with landowner permission via a Polaris Ranger. The large riparian area was native forest with dense vegetation on the left bank and improved pasture on the right bank (Table 4.5). Access was difficult as stream banks leading to the channel were steep and slippery on both the left and right banks. Figures 4.75 and 4.76 depict the appearance of the site during each of the surveys.

Figure 4.75 Photograph of White Oak Creek Site WH34 taken on July 21, 2016. Upstream view of the 300-m transect.

Site WH34 was wadeable with an average thalweg of 0.8 m during the first survey and 0.6 m in the second survey (Table 4.6). The stream flow at this site was designated as intermittent during both surveys. Stream widths ranged from a minimum of 4 m to a maximum of 12 m during the first survey to a minimum of 8 m and a maximum of 13 m in the second survey. A typical average of the stream width at this site was 10 m in the first survey and 11 m during the second survey (Tables 4.7 and 4.8).

Aquatic vegetation was common and algae cover rare in the first survey, while both were absent in the second survey (Tables 4.9 and 4.10). Tree debris and moss littered the stream channel throughout the 300-m reach during both surveys. Reptiles, water dependent birds, or mammals were not present during either survey. Evidence of wildlife included raccoon and beaver tracks and hog wallows during the first survey and hog and otter tracks and hog wallows in the second survey. Bird droppings on the banks and trees, crawfish and crawfish burrows, and clams were present during both surveys. Garbage in the stream channel or on the banks was absent at this site during both surveys. There was no evidence of human presence at this site during either survey.

Figure 4.76 Photograph of White Oak Creek Site WH34 taken on August 9, 2016. Downstream view of the 0-m transect.

Physical Description of WH35

White Oak Creek at site WH35 was visited on July 22 and August 7, 2016. This site was located where FM 69 intersects with White Oak Creek in Hopkins County. The portion of FM 69 near this site appeared to receive a large volume of traffic moving at a fast rate of speed. This site was publically accessible at the road crossing. TIAER personnel entered the stream at this road crossing and completed the survey up and downstream. The riparian area was large with thick, native forest vegetation extending into the banks at this site. Stream banks were steep and slick with overgrown, dense vegetation making access to the stream moderately difficult (Table 4.5). Figures 4.77 and 4.78 illustrate the general appearance of this site during each of the surveys.

Figure 4.77 Photograph of White Oak Creek Site WH35 taken on July 22, 2016. Upstream view of the 150-m transect.

A water moccasin was observed in the middle of the stream channel during the first survey at the 270-m transect. Due to this dangerous obstruction, TIAER personnel made the decision not to continue the survey to the 300-m transect. Photographic evidence was collected at the 270-m transect. While loading field equipment, it was noticed the snake was no longer in sight. TIAER personnel then walked to the 300-m transect to collect depth measurements but did not retake photos of upstream, left bank, downstream, and right bank of this transect.

Site WH35 was wadeable during both surveys with average thalweg depths of 0.6 m during both surveys (Table 4.6). Stream widths varied from a minimum of 1.4 m to a maximum of 9 m during the first survey to a minimum of 3 m and a maximum of 8.2 m in the second survey. A typical average of the stream width at this site was 8 m in the first survey and 6 m during the second survey (Tables 4.7 and 4.8).

Figure 4.78 Photograph of White Oak Creek Site WH35 taken on August 7, 2016. Upstream view of the 0-m transect. TIAER personnel in photo.

The stream flow type at the time of the first survey appeared to be intermittent. The shallowest depth measured was during the first survey and was 0.3 at the 150-m and 270-m transects. The deepest depth measured during the second survey was 0.9 m at the 120-m transect. Aquatic vegetation and odor were absent during both surveys (Tables 4.9 and 4.10). Algae cover was absent during the first survey, but present during the second. The water was brown with a clear surface during the first survey. However, floating scum and tree debris were observed within the 300-m reach. Logjams and low hanging trees were common at this site. The primary substrate at Site WH35 was fine sediment and sludge.

Raccoon, canine, feline, beaver, and otter tracks were observed at this site during the first survey. Feline tracks larger than those observed during the first survey were also present during the second survey along with otter and beaver tracks. Bird droppings, feathers, and nests were observed during both surveys as were crawfish and crawfish burrows, and clams. A water moccasin was present during the second survey, but was not obstructing further channel navigation.

A large rug was partially submerged under the road crossing during both surveys. Other trash was rarely observed within the stream channel along the banks. Trash consisted of typical plastics and aluminum cans.

Physical Description of WH36

Site WH36 on White Oak Creek was surveyed on July 21 and August 8, 2016. This site was located on private property approximately 0.30 miles downstream of CR 3504 in Hopkins County. Permission was granted by the landowner to access the property leading to this site. TIAER personnel traveled via truck through a locked gate and continued through pastureland about 0.5 miles to reach the stream. The riparian area associated with WH36 was large with forest like vegetation and bounded the stream channel with steep banks (Table 4.5). The general appearance of the creek at this location is shown in Figures 4.79 and 4.80.

Figure 4.79 Photograph of White Oak Creek Site WH36 taken on July 21, 2016. Downstream view of the 300-m transect.

The average thalweg depths of 0.6 m during the first survey and 0.7 m during the second survey made site WH36 wadeable for both survey events (Table 4.6). Widths did not vary significantly between surveys with a maximum width of 11 m and a typical average width of 3.5 m during both surveys (Tables 4.7 and 4.8). The minimum width was 2 m during the first survey and 1.6 m during the second survey.

The stream flow type at the time of the first survey appeared to be intermittent. The shallowest depth measured was during the first survey and was 0.14 m at the 270-m transect. Aquatic vegetation and algae were absent and the water was brown with a clear surface during both surveys. The primary substrate was fine sediment and sludge (Tables 4.9 and 4.10). TIAER personnel noted “sinking mud” during the first survey. This made walking in the channel difficult as one would sink into the sludgy mud as they walked. Additionally, logjams at the 30-m and 150-m transects and submerged debris were observed in the channel during the first survey. These logjams and debris were large obstacles for TIAER personnel in traversing the creek.

Figure 4.80 Photograph of White Oak Creek Site WH36 taken on August 8, 2016. Downstream view of the 0-m transect.

Armadillo, raccoon, hog, and squirrel tracks were observed in the channel, as were crawfish burrows, clamshells, and frogs. Bird droppings, wildlife burrows (holes), and trails were also observed during the first survey. Bobcat tracks were spotted by TIAER personnel during the second survey. During both surveys, TIAER personnel noted typical garbage of aluminum cans and glass bottles in the stream channel. Large garbage at this site included a tire on the bank. No evidence of human recreation was observed at this site.

Physical Description of WH37

Visited on July 21 and August 8, 2016, site WH37 is publically accessible where CR 3504 in Hopkins County intersects White Oak Creek. Access was moderately difficult due to the large amounts of rip-rap, concrete, and garbage on the stream banks at the road crossing. Private property extended beyond the road crossing with fencing alongside, but not up to, the bridge. This site was only publically accessible at the road crossing and permission from the landowner had to be acquired prior to the surveys.

At this site, White Oak Creek passes through improved pastures with native vegetation. The riparian area was large with trees and varied between pasture land and forest type vegetation leading up to the edge of the stream bank. The general appearance at this location is shown in Figures 4.81 and 4.82.

Figure 4.81 Photograph of White Oak Creek Site WH37 taken on July 21, 2016. Upstream view of the 150-m transect.

While some depths allowed for wading, non-wadeable depths were encountered during both surveys. The banks were steep and slippery, but TIAER personnel were able to climb over log obstructions in the channel to complete the 300-m reach during the first survey. However, due to a large, poisonous snake (water moccasin) that was encountered in the chest deep water between the 240-m transect and the 270-m transect, TIAER personnel were unable to complete the full 300-m reach during the second survey.

Average thalweg depths ranged from 0.8 m to 0.7 m between surveys with a stream flow type characterized as intermittent (Tables 4.5 and 4.6). Maximum stream widths were 16 m during both surveys, the typical observed width of the stream was 4 m during the during the first survey and 4.5 m in the second survey (Tables 4.7 and 4.8).

Figure 4.82 Photograph of White Oak Creek Site WH37 taken on August 8, 2016. Downstream view of the 150-m transect. TIAER personnel in photo.

Aquatic vegetation and algae cover was absent during both surveys. While there was no odor at this site during the first survey, TIAER personnel noticed a strong odor similar to that of a deceased animal during the second survey.

Raccoon and hog tracks were observed during the first survey along with frogs, a bird, and crawfish burrows in the channel. No evidence of wildlife was noted during the second survey. As mentioned above, this site proved to be somewhat of a dump for local residents. Large and small garbage was observed in the channel, and on the banks of the stream at the bridge crossing (Tables 4.9 and 4.10). Small garbage included glass bottles and aluminum cans during both surveys. Large garbage observed during the first survey included rebar and concrete blocks, chunks of asphalt, lots of tires, and an old vacuum cleaner. During the second survey, the same large garbage listed above was present along with a roll of carpet and a bag of ladies clothing. There was no evidence of human recreation at this site.

Physical Description of WH38

White Oak Creek RUAA site WH38 was surveyed on July 22 and August 8, 2016. This site was located on private property approximately 2.2 miles upstream of CR 3504 in Hopkins County. Access to this site was granted by the landowner to the property leading to White Oak Creek. TIAER personnel traveled via truck through a locked gate and continued through pastureland about two miles to reach the stream. The riparian area associated with WH38 is large and immediately bounded on both banks by forest (Table 4.5). The general appearance of the creek at this location is shown in Figures 4.83 and 4.84.

Figure 4.83 Photograph of White Oak Creek Site WH38 taken on July 22, 2016. Downstream view of the 0-m transect.

Site WH38 was wadeable for the entire 300-m reach with an average thalweg of 0.3 m during both surveys (Table 4.6). Widths of the stream were similar during the first and second surveys with minimums of 1.4 m and typical average widths of 5.0 m (Tables 4.7 and 4.8). Maximum widths varied from 7 m during the first survey to 10 m during the second survey.

The stream flow type at the time of the first survey appeared to be intermittent but was designated as intermittent with perennial pools during the second survey (Table 4.6). Water color was brown and aquatic vegetation and odor were absent, while algae cover was rare during both surveys at this site. Foam and scum were observed on the water surface throughout the 300-m reach during both survey events at this site.

Figure 4.84 Photograph of White Oak Creek Site WH38 taken on August 8, 2016. Upstream view of the 150-m transect.

TIAER personnel encountered a massive logjam at the 300-m transect. A water moccasin was seen and other evidence of wildlife that included otter, raccoon, and canine tracks, and otter and bird fecal droppings during the first survey. No evidence of wildlife was noted during the second RUAA survey. Garbage was noted in the stream channel during both surveys and included aluminum cans, plastic bottles, and glass bottles (Tables 4.9 and 4.10). No evidence of human recreation was observed at the site.

Physical Description of WH39

White Oak Creek site WH39 was visited on July 21 and August 7, 2016. This site was located where SH 19 in Hopkins County intersects the creek. The site was only publically accessible at the road crossing. There was no safe place to park a vehicle on the shoulder of the road due to a narrow shoulder and a high volume of very fast moving traffic. Thus, TIAER personnel had to drive down the overgrown, right-of-way near the bridge and enter the stream under the SH 19 Bridge.

The riparian area along the creek at this site was large with trees and native forest leading directly up to the stream bank (Table 4.5). Banks were steep and tall making it difficult for TIAER personnel to walk along the edge of the water. Logjams, low hanging trees, and debris prevented use of a boat. The sludge ("sinking mud") in the stream channel made this site unsuitable to wade. The general appearance of the creek at this location is shown in Figures 4.85 and 4.86.

Figure 4.85 Photograph of White Oak Creek Site WH39 taken on July 21, 2016. Upstream view of the 0-m transect.

Site WH39 was considered wadeable with an average thalweg of 0.7 m during both surveys (Table 4.6). However, due to water depths greater than 1.5 m between the 270-m transect and 300-m transect and steep banks greater than 1.5 m, TIAER personnel were unable to complete the full 300-m reach.

The stream flow at this site was designated as intermittent. Figure 4.85 illustrates the typical width of the creek at this site, approximately 8 m. Widths ranged from 4 m to 10 m in the first survey and 2.5 m to 10 m during the second survey (Tables 4.7 and 4.8).

Fish and aquatic vegetation were not observed at this site in either survey. Algae cover was rarely observed during the first survey. Throughout both surveys evidence of recent beaver activity in the stream included the presence of beaver tracks, slides, gnawed limbs, and burrows. Other typical presence of wildlife included raccoon tracks, squirrels, frogs, and crawfish burrows. A water moccasin was spotted at this site during both surveys.

Figure 4.86 Photograph of White Oak Creek Site WH39 taken on August 7, 2016. Upstream view of the 150-m transect.

Small garbage spotted at this site during both surveys included aluminum cans, glass bottles, and plastic bags. During the second survey, a medium sized mammal trap was seen in the water under the bridge (at the 150-m transect). No human presence was observed throughout the reach during either survey.

Physical Description of WH40

White Oak Creek Site WH40 was visited on July 22 and August 8, 2016. This site is publically accessible through a pipeline right-of-way in Hopkins County. Access to this site was moderately difficult, because the right-of-way was very overgrown, there was no designated parking area, and banks were steep leading down to the water.

Similar to WH39, the stream at WH40 also passed through thick native, forest vegetation with a large riparian area (Table 4.5). While some depths allowed for wading, non-wadeable depths were encountered during both surveys. Because banks were steep with thick vegetation, TIAER personnel used a 10-foot aluminum boat with a 5-hp motor to complete the surveys. Average thalweg depths 0.9 m for both surveys, and the stream flow type was characterized as intermittent (Table 4.6). Channel widths of the creek ranged from 4 m to 16 m during the first survey and 4 m to 17 m during the second survey. The typical average width remained 11 m during both surveys (Tables 4.7 and 4.8). Figure 4.87 illustrates a typical representation of this site, while Figure 3.88 illustrates the narrowest portion of the channel at this site, approximately 4 m wide.

Figure 4.87 Photograph of White Oak Creek Site WH40 taken on July 22, 2016. Upstream view of the 0-m transect.

This site's banks were heavily vegetated with large trees and a large shaded understory from the 0-m to the 150-m transects. A trotline, fish hook, and a grocery sack were spotted hanging from trees during the first survey. It was common for banks to be covered in spider webs at this site. These webs held onto snakeskins and tree debris, such as leaves, small sticks, and bark.

Fish, aquatic vegetation, and algae were absent at this site during both surveys. The water color was clear and brown in color during both surveys (Tables 4.9 and 4.10). Typical evidence of wildlife included hog wallows, raccoon tracks, animal burrows, and bird fecal droppings was noted during both surveys. Clam shells, frogs, and crawfish burrows were also present during both surveys. No human recreation was observed at this site.

Figure 4.88 Photograph of White Oak Creek Site WH40 taken on August 8, 2016. Upstream view of the 300-m transect. TIAER personnel in photo.

Physical Description of WH41

White Oak Creek site WH41 was visited on July 20 and August 8, 2016. Located approximately 120 river miles from the confluence with the Sulphur River, site WH41 was on White Oak Creek at FM 2285 in Sulphur Springs. This site is considered publically accessible, because the 300-m transect for this site was located just below the dam of Lake Sulphur Springs. However, access was considered moderately difficult due to the large amounts of rocks that TIAER personnel had to climb over in order to access the stream.

The creek at this site passed through improved pastures with native vegetation. The large riparian area on the right and left banks held trees and native pasture leading directly up to the edge of the stream bank. Unlike other areas along White Oak Creek, banks at this site were not considered steep by TIAER personnel. The dominant substrate of the stream was mud/clay with rip rap and concrete at the 300-m transect where the stream meets with the Lake Sulphur Springs dam (Table 4.5). The general appearance of the creek at this site is shown in Figures 4.89 and 4.90.

Figure 4.89 Photograph of White Oak Creek Site WH41 taken on July 20, 2016. Downstream view of the 150-m transect. TIAER personnel in photo.

White Oak Creek site WH41 was wadeable with an average thalweg ranging from 0.3 m on the first survey to 0.4 m on the second survey (Table 4.6). Widths of the stream averaged 3.5 m between the two surveys. However, the widest point of the stream at this site measured 20 m during both surveys (Tables 4.7 and 4.8).

Figure 4.90 Photograph of White Oak Creek Site WH41 taken on August 8, 2016. Downstream view of the 0-m transect.

The stream flow type at the time of the first survey appeared to be intermittent but was designated as intermittent with perennial pools during the second survey (Table 4.6). Aquatic vegetation was common and algae cover was rare during both surveys. No odor was encountered and the color of the water was brown during both surveys. Foam was noted on the surface of the water along the 300-m reach in both surveys. While no wildlife was observed during either survey, evidence of wildlife by means of tracks and fecal droppings were observed during both surveys.

Additionally, large and small garbage in the stream included glass bottles, aluminum cans, plastic bottles, and a section of a guard rail from the highway was noted on both surveys (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited sites during times and on days when recreational activities were most likely to be observed. Access points for 31 of the 41 sites were located at public road crossings, while 10 sites were accessible via private property. All public sites allowed up and downstream travel with no fences bisecting the channel. At Site WH37, there was fencing both upstream and downstream from the bridge crossing, but landowner permission was granted to survey beyond the fences. No primary recreation was directly observed by TIAER staff during either survey.

Activities Interviewed

A total of 19 interviews were collected from landowners along White Oak Creek as well as others with interest in the watershed.

Interviews were received from local residents who had familiarity with White Oak Creek ranging from 4 to 85 years with the majority of residents having more than 25 years of experience with the creek. The interviews indicated hunting/trapping and fishing as the most common recreational activities occurring throughout the stream. Duck hunting was the only specific type of hunting mentioned in the interviews. Another interviewee indicated having put out trotlines for catching fish. Boating was reported primarily for the lower portion of the creek. One interviewee did indicate having heard of someone swimming in the creek but did not specify a location. Another interview indicated having participated in and witnessed adults wading in the portion of White Oak Creek between sites WH31 and WH35.

One interviewee indicated that the reason they had not observed or heard of individuals using White Oak Creek for recreational purposes was because the creek is not open to the public.

One interviewee familiar with site WH37 indicated that they had not oberserved or heard of anyone using the creek for recreational purposes. The interviewee provided additional comments that characterized the creek at site WH37 as always having water that was dark in color, stagnant, and muddy. This interviewee also indicated there were more appealing places to recreate and that in addition to the aesthitics of the water, the presenence of snakes was also a reason the creek was not used for recreation. Two other interviewees mentioned snakes as a reason for not recreating in the creek. Additional hindrances mentioned were lack of water, excess vegetation, and logjams.

Hunting in or near White Oak Creek was indicated at 13 sites. Fishing was associated with 16 sites. Boating was mentioned to have taken place at 8 sites and trapping was mentioned as occurring at 7 sites.

Three surveys addressed White Oak Creek in general terms, not specifying a specific site or location. These interviews reflected adult wading, swimming, hunting, fishing, and boating taking place in the creek.

Based on interviews, reconnaissance, and surveys, White Oak Creek appears to primarily be used for fishing and hunting. Boating is commonly used to facilitate fishing and setting out trotlines away from road crossings. Hunting, which is allowable by the public within the WMA, is also a commonly reported use of the creek corridor. Interviews and conversations with locals confirmed the brown and murky water as seen in the surveys as a consistent characteristic of White Oak Creek. Snakes were prevalent in the creek corridor during surveys and commonly mentioned by interviewees and in conversations with local stakeholders.

Activities are listed in Table 4.12 as the number of times personal use, observed use, and/or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells in Table 4.12 indicate no interviewed feedback for that location. An * in Table 4.12 indicates recreation reported from an interview for another location.

Table 4.12 Summary of recreational activities noted in interviews for White Oak Creek.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak	Trapping
WH01								
WH02								
WH03								
WH04								
WH05								
WH06								
WH07								
WH08	4				1,2,2	3,4,3	3,3,3	1,0,0
WH09								
WH10								
WH11								
WH12								
WH13								
WH14	1				0,1,1	0,1,1	1,0,0	
WH15								
WH16								
WH17								
WH18								
WH19								
WH20								
WH21								
WH22								
WH23								

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak	Trapping
WH24	1*				*,*,*	*,1,*	*,*,*	
WH25	*				*,*,*	*,*,*	*,*,*	
WH26	*				*,*,*	*,*,*	*,*,*	
WH27	*				*,*,*	*,*,*	*,*,*	
WH28	1				1,1,1	1,1,1	1,1,1	
WH29								
WH30	4*				1*,1*,1*	1*,1*,0*	*,*,*	1,1,1
WH31	1*		1,1,0		1*,1*,1*	1,1,1		0*,1*,1*
WH32	*		*,*,0		*,*,*	*,*,*		*,*,*
WH33	*		*,*,0		*,*,*	*,*,*		*,*,*
WH34	*		*,*,0		*,*,*	*,*,*		*,*,*
WH35	1*		*,*,0		*,*,*	*,*,*		*,*,*
WH36	1					1,1,1		
WH37	1*					*,*,*		
WH38								
WH39						0,*,0		
WH40								
WH41								
General AU	3	0,0,1			2,2,2	2,2,2	0,1,1	
Totals	18	0,0,1	1*,1*,0*	0,0,0	6*,8*,8,*	9*,12*,9*	5*,5*,5*	2*,2*,2*

* indicates recreation reported from an interview from another location

Summary

RUAA surveys were conducted at thirty-six sites along White Oak Creek (0303B) on June 22 – 23, July 19 – 22, August 7 – 11, and August 25, 2016. Temperatures were above 21ºC (70ºF) during the 30 days prior to each survey (Tables 4.2 and 4.3). Streamflow was considered flooded to high at the seventeen most downstream sites (WH17 –WH01) during the first survey, while streamflow at the upstream sites appeared normal. Streamflow was high at the downstream sites during the second survey, while the streamflow at the upstream sites remained mostly normal based on observations and information provided by local residents. The Palmer Drought Severity Index (PDSI) indicated very moist to extremely moist conditions for June through August 2016 (NOAA, Historical Palmer Drought Indices, 2016).

No recreational activities were observed by TIAER field staff during either survey.

Public access to the creek was available through the White Oak Creek Wildlife Management Area, which has multiple locations within its borders. There are ten designated entrance and information stations with parking, two small craft/boat launches, and two specified equestrian trail heads within the WMA. Access to White Oak Creek was also possible by boating upstream from the confluence with the Sulphur River, although access may be blocked by channel obstructions during periods of lower flows. Other public access points included the right-of-ways immediately surrounding roadway bridge crossings. During periods of higher water levels, travel through the channel is limited by channel obstructions, such as canopy of flooded understory vegetation, downed trees, logjams, and debris jams.

Recreational activities reported in interviews are summarized in Figures 4.91 – 4.93 for specific sites. General use noted from interviews is summarized in Table 4.12. Overall RUAA findings are summarized in the form below.

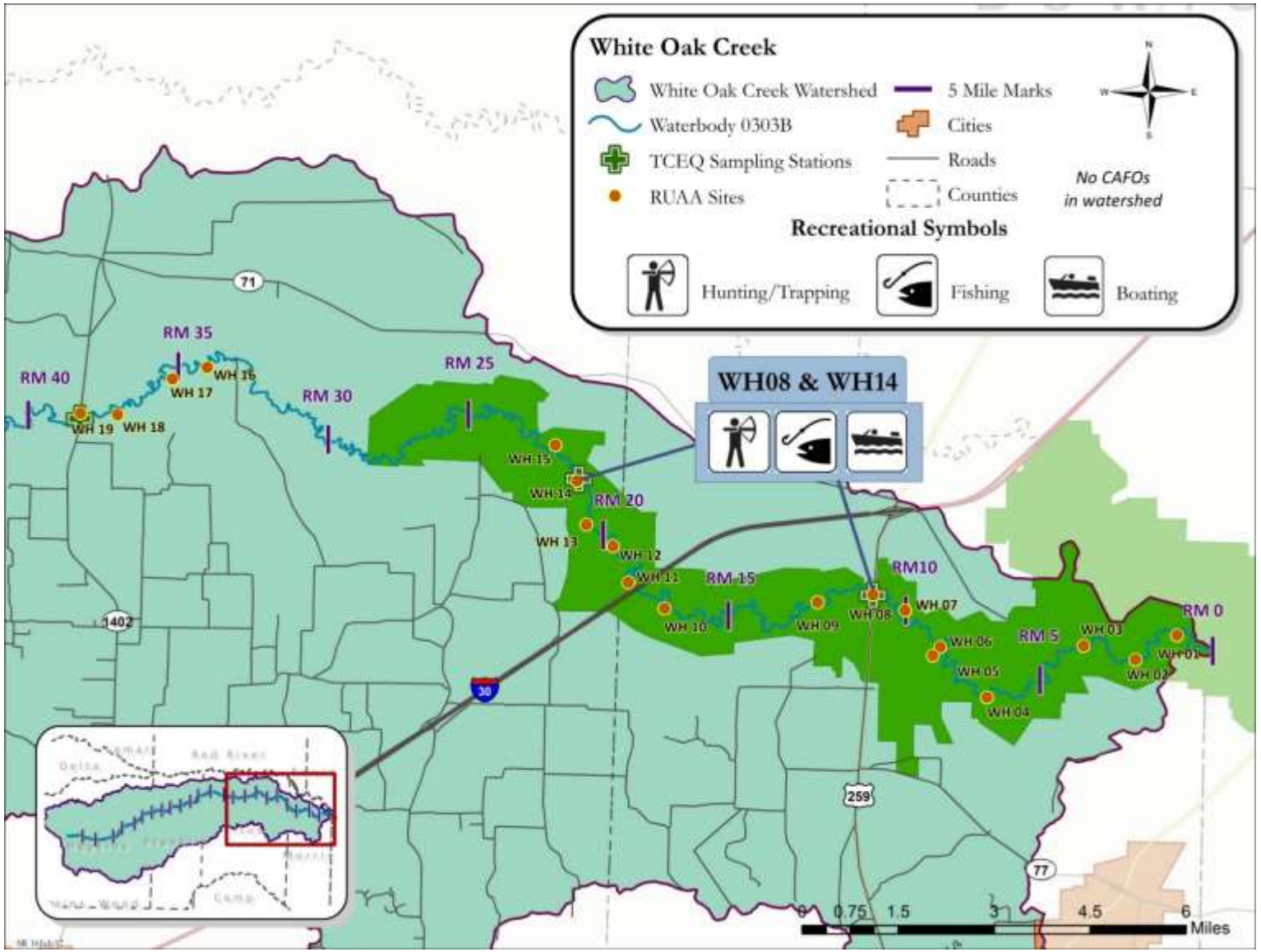

Figure 4.91 Summary of recreational activities reported in interview for White Oak Creek from Sites WH01 – WH19.

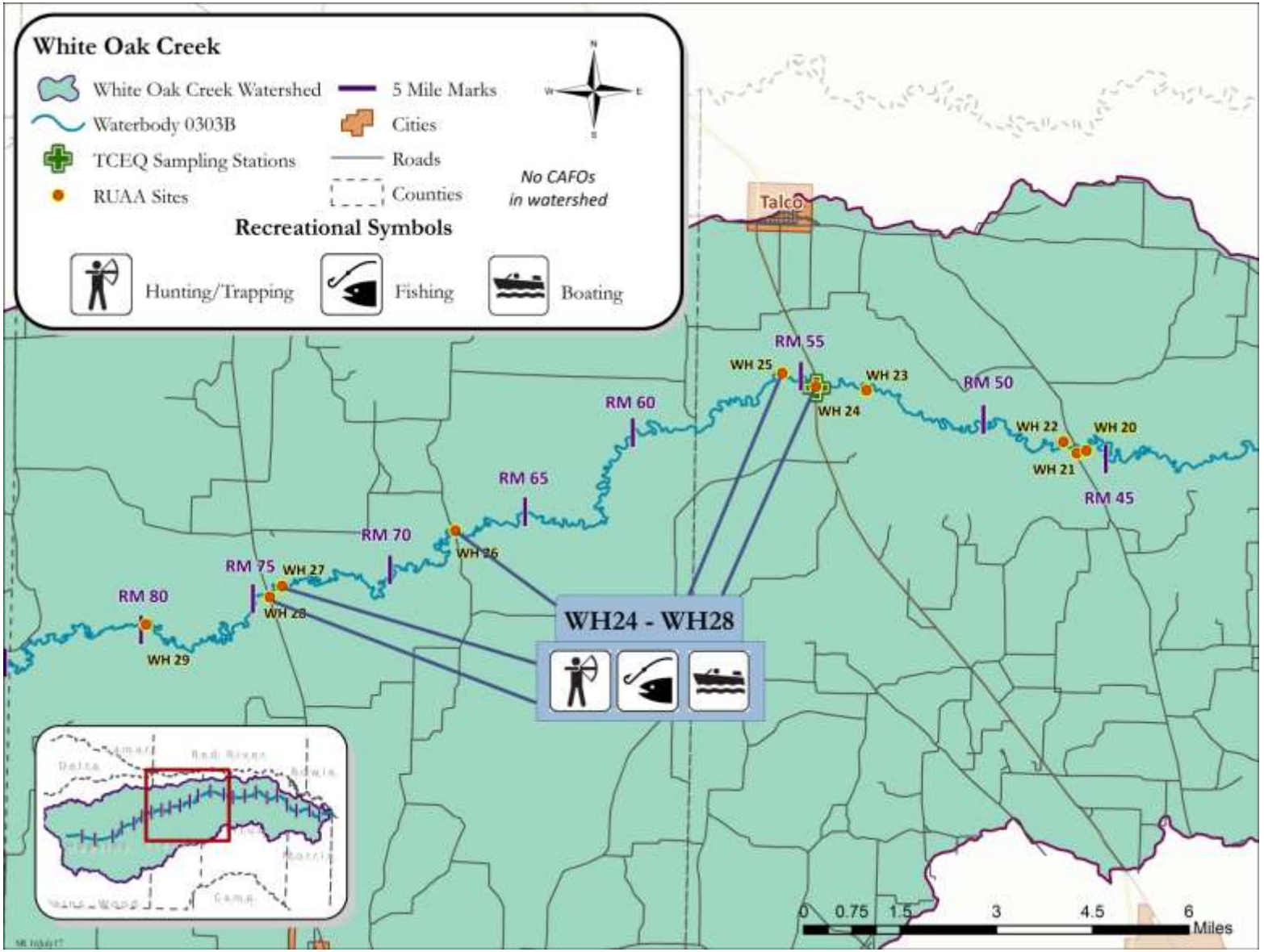

Figure 4.92 Summary of recreational activities reported in interview for White Oak Creek from Sites WH20 – WH29.

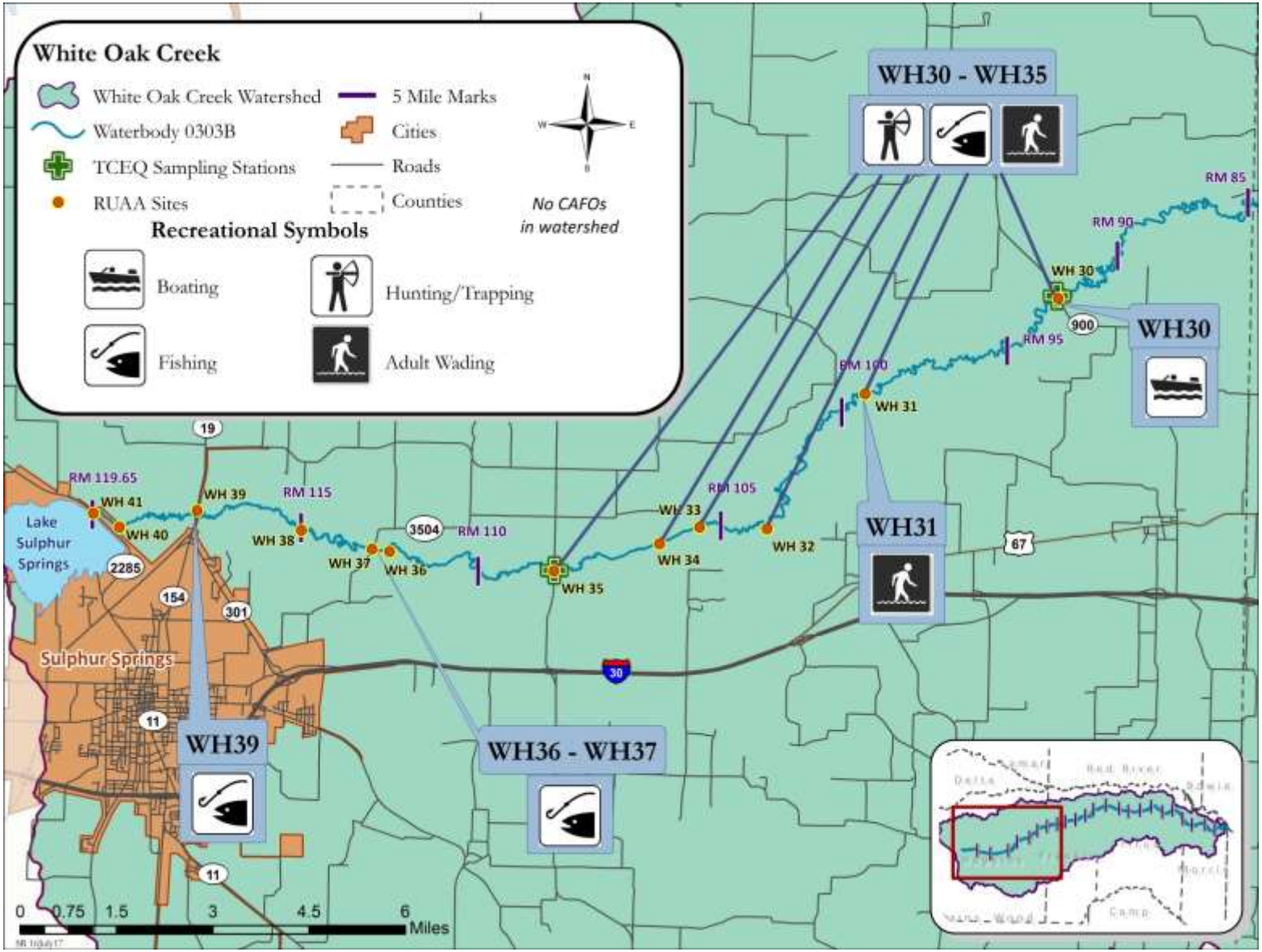

Figure 4.93 Summary of recreational activities reported in interviews for White Oak Creek from Sites WH30 – WH41.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: White Oak Creek
Segment No. of Nearest Downstream Segment No.: Segment 0303
Classified?: No
County: Hopkins, Franklin, Titus, Morris

1. Observations on Use
   a. Do primary contact recreation activities occur on the water body?
   ☐frequently ☒ seldom ☐not observed or reported ☐unknown
   b. Do secondary contact recreation 1 activities occur on the water body?
   ☐frequently ☒seldom ☐not observed or reported ☐unknown
   c. Do secondary contact recreation 2 activities occur on the water body?
   ☐frequently ☒seldom ☐not observed or reported ☐unknown
   d. Do noncontact recreation activities occur on the water body?
   ☐frequently ☒seldom ☐not observed or reported ☐unknown

2. Physical Characteristics of Water Body
   a. What is the average thalweg depth? 1.0 m
   b. Are there substantial pools deeper than 1 meter? ☐Yes ☒No
   c. What is the general level of public access?
   ☐easy ☐moderate ☒very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)
   ☐Mild-Extreme Drought
   ☐Incipient dry spell
   ☐Near Normal
   ☐Incipient wet spell
   ☒Mild-Extreme Wet

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Appendix A.
White Oak Creek RUAA Sites

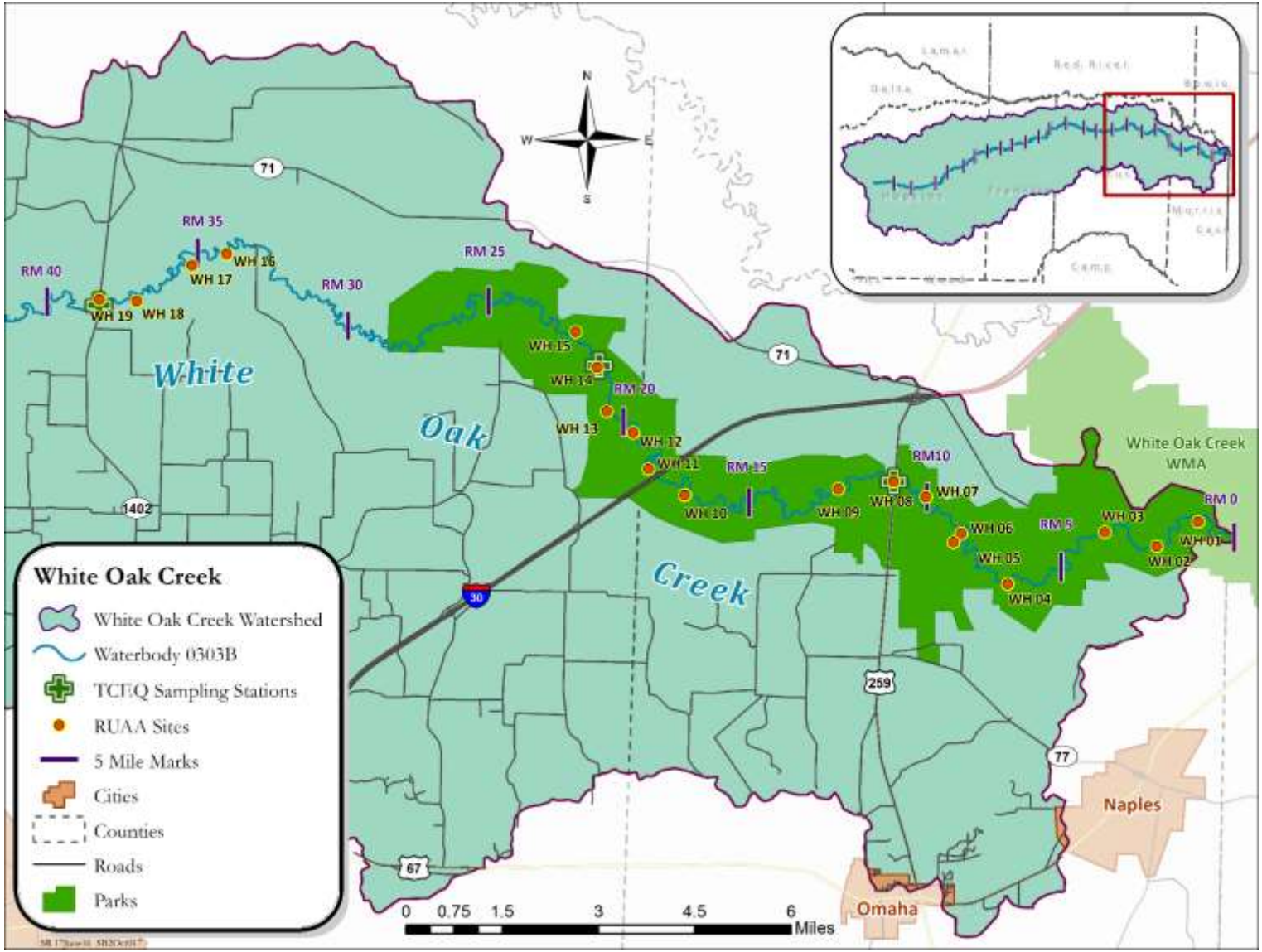

Figure A.1 White Oak Creek RUAA Survey Sites from Sites WH01 – WH19.

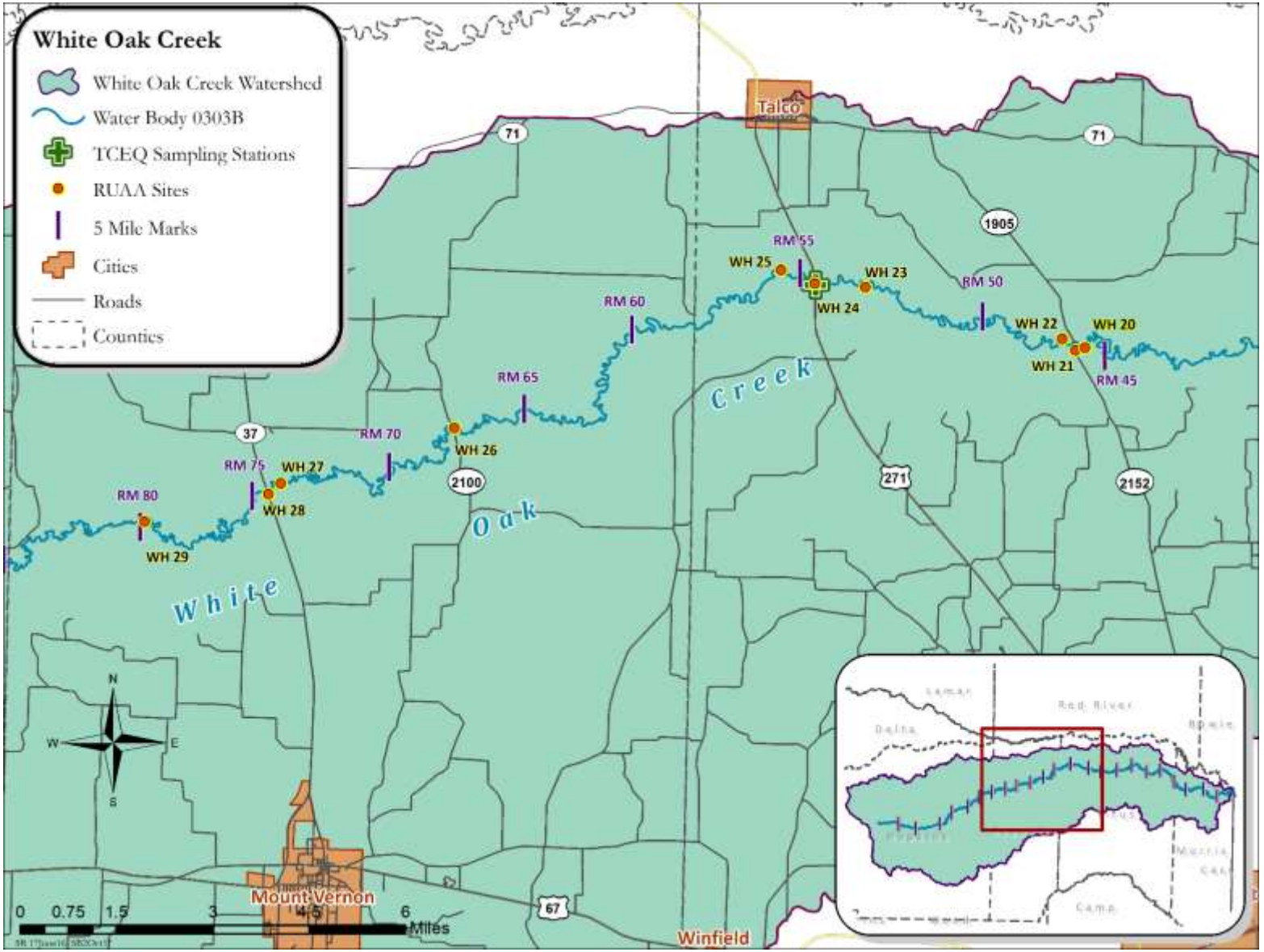

Figure A.2 White Oak Creek RUAA Survey Sites from Sites WH20 – WH29.

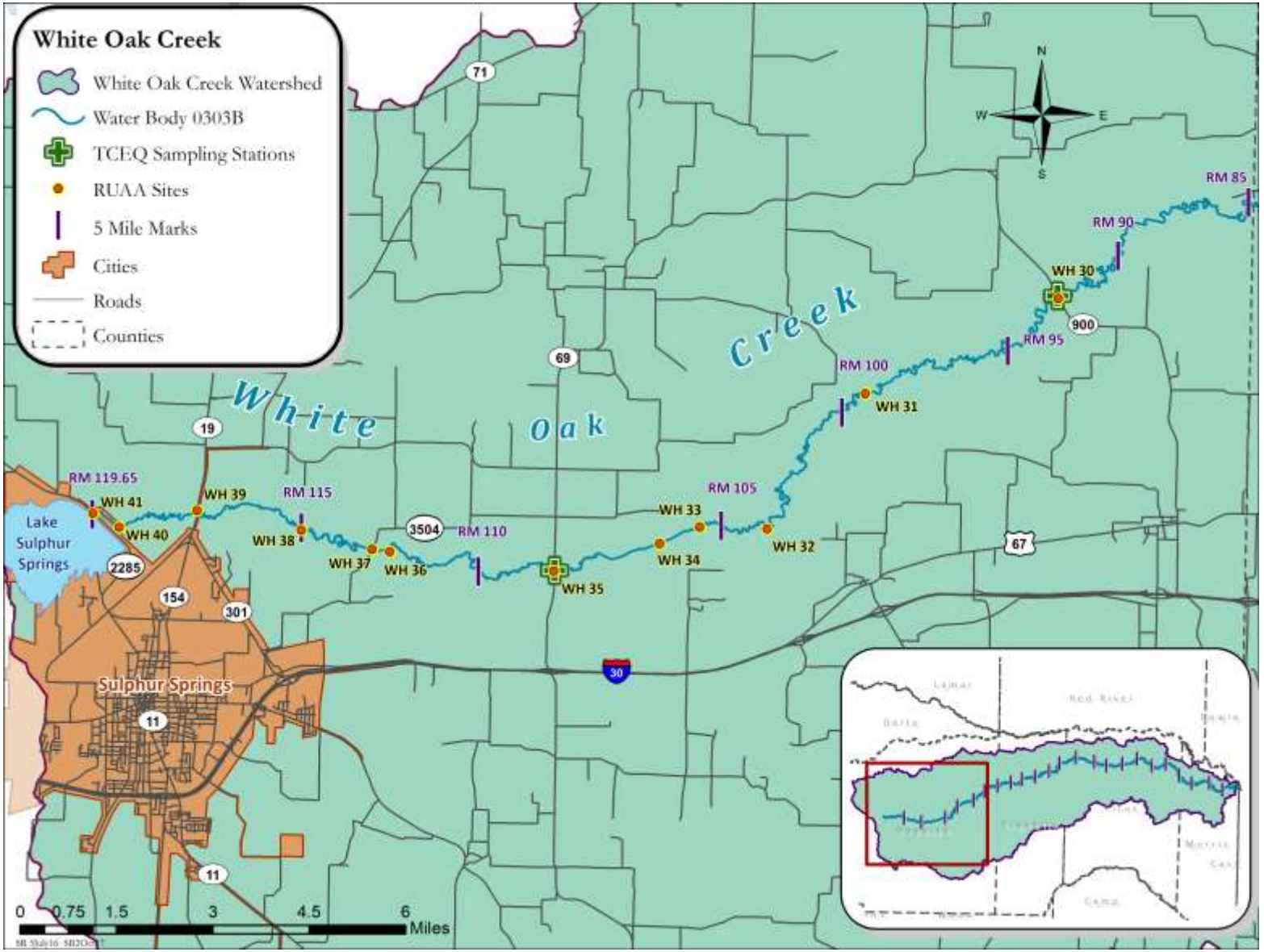

Figure A.3 White Oak Creek RUAA Survey Sites from Sites WH30 – WH41.